

Social-psychological aspects of domestic renewable energy: A study of low-income tenants' responses to solar photovoltaics

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Abstract

If the UK is to achieve the aim of moving to a low-carbon society, it is necessary to understand the factors involved in public acceptance of new energy technologies. To date however, there is little research exploring responses to renewable energy technologies in low-income households and disadvantaged communities, especially where those technologies are 'imposed' by outside agencies. This research attempts to address this gap by investigating perceptions of and attitudes towards solar photovoltaic (PV) panels in a 'New Deal for Communities' area in Leicester (UK).

Forty-two semi-structured interviews were conducted with tenants of the solar homes prior to installation of PV panels. A theoretical framework reflecting issues of technology diffusion, place-related social identity and social networks was used as a template in coding participants' accounts. A follow-up questionnaire survey (n=13) was used to explore some of the issues arising from the interviews.

Findings suggest that participants' perceptions of PV prior to installation reflect constructs from Rogers' (2003) attribute-perception model, but that this model did not capture all factors that influenced perceptions of PV. Tenants recognised personal and community benefits from PV. However, some concern was expressed about the outcomes of installation and some participants reported a lack of interest and little awareness of the technology. In addition, there were concerns that the scheme may damage community relations by inspiring envy in those whose houses were not included.

Taken as a whole, these findings stress the importance of investigating tenants' perceptions prior to implementation of the project. The second study found that if tenants do not save money from PV then they will have a negative attitude towards it. From these findings, conclusions are drawn about the potential for successfully implementing similar schemes in areas undergoing urban regeneration and suggest some ways in which this process can be facilitated.

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Abbreviations and Acronyms

Several abbreviations and acronyms are used in this thesis. Although each is spelled out on its first usage in a chapter, they are collected here for ease of reference.

APA	American Psychological Association
BCA	Braunstone Community Association
CO ₂	Carbon Dioxide
CIS	City Identity Sustainability
DBERR	Department for Business Enterprise and Regulatory Reform
DEFRA	Department for the Environment, Food and Rural Affairs
DIT	Diffusion of Innovations Theory
DTI	Department of Trade and Industry
EMRA	East Midlands Regional Assembly
EST	Energy Saving Trust
EU	European Union
GOEM	Government Office for the East Midlands
GWLL	Groundwork Leicester and Leicestershire
IEA	International Energy Agency
IPCC	Inter governmental Panel on Climate Change
LCC	Leicestershire County Council
LHA	Leicester Housing Association
MPVDP	Major Photovoltaic Demonstration Programme
MSA	Multiple Scalogram Analysis
MST	Multiple Sort Task
NRF	Neighbourhood Renewal Fund
ODPM	Office of the Deputy Prime Minister
ONS	Office of National Statistics
PPS22	Planning Process Statement 22
PRSI	Place-Related Social Identity
PV	Photovoltaic

RCEP	Royal Commission on Environmental Pollution
RET	Renewable Energy Technology
RETs	Renewable Energy Technologies
SAP	Standard Assessment Procedure
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America

1 Introduction

This thesis presents a longitudinal investigation of an urban neighbourhood renewable energy scheme. More specifically, using interviews and questionnaires, it explores low-income tenants' responses to the installation of solar photovoltaic (PV) systems on fifty homes within a 'New Deal for Communities' area of Leicester, UK, following government support for renewables via the Major PV Demonstration programme (MPVDP). The aim is to aid understanding of the factors involved in public acceptance of new energy technologies. Frameworks provided by theories of place and technology diffusion are used to examine social and psychological aspects of implementation of renewable energy technologies within a social housing context.

Despite solar power being increasingly recognised as a domestic solution to reduce carbon emissions, a number of government-commissioned reports looking at public awareness of and attitudes towards renewable energy technologies (e.g. Barker and Riddington, 2003; Department for Business, Enterprise and Regulatory Reform [DBERR], 2007) and UK government support for the commercialisation of the photovoltaic industry; there has been a paucity of systematic academic study of the social and psychological aspects of solar PV use. Further to this, there have been a small number of studies looking at local aspects of renewable energy projects from a citizen perspective (e.g. Devine-Wright, 2005; Hoffman and High-Pippert, 2005) and within developing countries (Schweizer-Reis, Casper, Djuwita, Ramirez, & Hidalgo de Avila, 2001). However, little is currently understood about the perceptions and attitudes towards renewable energy technologies in lower socio-economic groups within the UK, or towards renewable energy projects that are characterised by a low level of local involvement.

Understanding factors that affect the implementation and outcome of small-scale renewable energy technology across a social housing estate is important in providing practical, policy-relevant insights that will be applicable to similar contexts across the

UK. Insights are also provided on the outcomes of UK government supported renewable energy schemes.

1.1 Background to the project

The International Energy Agency (IEA) anticipates that by 2030 primary global energy demand is set to increase by over 50% of current demand (IEA, 2006). The major source of global energy continues to be from the combustion of fossil fuels such as oil, coal and natural gas. Concurrently, the release of CO₂ from fossil fuels has been identified as causing rises in the average global surface temperature as a result of interference with the naturally occurring greenhouse effect (Intergovernmental Panel on Climate Change [IPCC], 2007b). The IPCC has implied that a key consequence of this interference with the greenhouse effect will be changes to the global climate that would predominantly result in adverse effects on the natural and human environment (IPCC, 2001; 2007a).

In 2007, the United Nations' Intergovernmental Panel on Climate Change (IPCC), which is comprised of some of the world's most eminent cross-disciplinary scientists, reaffirmed its 2001 conclusion that current observed global warming is *very likely* to be due to the release of greenhouse gases caused by anthropological (human) activities (such as transportation and electricity needs), where *very likely* means a 90% probability (IPCC, 2001; 2007b).

Following this, governments internationally are now confronted with difficult policy decisions to balance energy production, supply and increasing demand with the requirement to meet national and international climate change objectives and targets.

At local government level, Leicester has a long history of working in the energy efficiency and renewable energy fields. It installed solar water heating on buildings in the 1970's, was one of the government's lead Cities for Combined Heat and Power in the 1980's, developed one of the UK's first Local Energy Strategies in the 1990s and was the UK's First Environment City in 1990. In 1992, it was one of only 12 authorities

(one of three from Europe) to attend the Rio Earth summit. Since 2000, it has developed a Climate Change Strategy and in 2005 was selected as a Beacon Council for Sustainable Energy. This long history of local energy initiatives informed the development of the 'Solar Streets' project.

1.2 UK climate change policy

Recent UK government energy policy, as set out in the 2007 Energy White Paper *Meeting the Energy Challenge* (DTI, 2007), seeks to address the issues of security of supply, affordability of fuel and the adverse effects of climate change. The government has also set out policies to address climate change through the 2006 publication *Climate Change: The UK Programme 2006* (DEFRA, 2006). Importantly, these policies incorporate the year 2000 recommendation from the Royal Commission on Environmental Pollution's twenty-second report, *Energy – The Changing Climate*, to reduce CO₂ emissions by 60% of 1990 emission levels by 2050 (RCEP, 2000).

In dealing with this target the 2007 Energy White Paper highlights that renewable energy – non-finite, naturally occurring energy - “is an integral part of the Government's strategy for reducing carbon emissions as renewable energy resources produce very little carbon or other greenhouse gases” (DTI, 2007 p143) and that renewable energy technologies “can also make a contribution to security of supply, by diversifying the electricity mix and reducing the need for energy imports” (DTI, 2007 p143).

Government policies relating to renewable energy technologies (RETs) relate to both large and small scale energy generation systems (e.g. from large offshore wind farms to small wind turbines for an individual house). Small-scale RETs are referred to as micro-generation systems.

1.3 Micro-generation

Micro-generation is defined as “the small-scale production of heat and/or electricity from a low carbon-source” (DTI, 2006 p4). Micro-generation systems include solar

photovoltaics, solar thermal, micro-wind, micro-hydro, heat pumps, biomass, micro-combined heat and power, and micro-level fuel cells. The significance of the potential benefits that these small systems can provide to reduce UK CO₂ levels is reflected in the production of the UK Micro-generation Strategy *Our Energy Challenge: Power from the people* (DTI, 2006). The strategy highlights research by the Energy Savings Trust (EST) that suggests that micro-generation could provide 30-40% of the UK's electricity needs by 2050 and help to reduce household carbon emissions by 15% per annum. In addition, it suggests that micro-generation can significantly help achieve the objectives of the Energy White Paper by contributing to a reduction in fuel poverty as well as a reduction in carbon emissions by 20% of 1990 levels by 2020 (DTI, 2003).

There is growing pressure for the increase in small-scale renewable energy. "In 2004 the domestic sector was responsible for about 30% of total UK energy use and about 27% of carbon dioxide emissions on an end user basis" (DEFRA, 2006 p75). Further to this, a report by the Environmental Audit Committee (2005) suggests that consumption is rising to the extent that the housing sector could account for double this amount by 2050. The overarching objective of the micro-generation strategy is to create the conditions in which micro-generation can become "a realistic alternative or supplementary energy generation source for the householder, for the community and for small businesses" (DTI, 2006 p4). The strategy therefore links into wider government policy concerned with a balance between 'community', social wellbeing and sustainable development.

As well as the micro-generation strategy, there has also been an increase in government discourse on the need for regional action on climate change through the revision of the planning process guidelines for delivery of local renewable energy as set out in the Planning Process Statement 22 (PPS 22) (Office for the Deputy Prime Minister [ODPM], 2004a). This put into context the obligations of local councils when assessing renewable energy technology (RET) applications and placed more emphasis on commitment to public engagement in local renewable energy projects. It states that "local planning authorities, regional stakeholders and Local Strategic Partnerships

should foster community involvement in renewable energy projects and seek to promote knowledge of and greater acceptance by the public of prospective renewable energy developments that are appropriately located.” (ODPM, 2004a p8). Government guidance concerning PPS22 goes on to highlight potential benefits concerning community involvement. It states that:

Community involvement is especially important in planning for renewable energy because it can help provide an opportunity to engage local people actively in the development of schemes; to address concerns about the impacts of potential schemes; and to explain the wider benefits of renewable energy” (ODPM, 2004b p18).

This emphasis on community is reflected in the Local Agenda 21 objectives set out at the 1992 Rio Earth Summit which influenced local authority policy and the motto ‘think global, act local’. Additionally, the recent increase in political attention on the relatively new concept of personal carbon trading also suggests a more personal approach to environmental action (Royal Society of Arts, 2007).

In light of this political focus on public involvement, there are various capital grants available from the UK government to implement local renewable energy projects and many UK public and private sector organisations are working to promote community ownership of renewable energy projects such as the community renewables initiative (DTI, 2002a).

1.4 Solar photovoltaics (PV)

Solar photovoltaic (PV) cells convert energy from sunlight into an electrical current (Kraushaar and Ristinen, 1993). Solar electricity can be generated through both small and large scale installations such as in pocket calculators and garden lighting to individual buildings or as solar power stations (Firth, 2006). When used on buildings, PV arrays can be retrofitted or integrated into building walls, facades and roofs and can be connected to the local electricity network; in which case, PV electricity can be

exported to the centralised (national) grid. As well as the advantage of solar energy producing no harmful waste products, PV has no moving parts, is not noisy when in operation and has low maintenance considerations. Furthermore, planning permission is not necessary prior to their installation in the UK. Therefore, environmental considerations such as visual intrusion, noise and impacts on land use and wildlife are relatively unproblematic issues in contrast to other RETs, such as wind energy. This is reflected in public perceptions of solar PV as reported in a 2003 government commissioned study investigating public attitudes to renewable energy (Barker and Riddington, 2003). The study suggested that compared to other RETs, solar PV is seen as having low localised impact. Noteworthy, is that with regard to renewable energy generally:

Solar power was the most readily accepted form of renewable energy. Participants saw that they, as individuals, could contribute to energy generation through solar panels on homes. Solar energy schemes were perceived as having the lowest impact on the local area and being suitable for both rural and urban areas (Barker and Riddington, 2003 p15).

This quotation suggests that there is more support for solar than other renewable technologies and that embedded generation of electricity highlights the issue of energy use and transmission for users. In line with this argument, Pasqualetti (1999) suggests that localised renewable energy schemes reduce the spatial and psychological distance between energy generation and the user.

Currently there are government solar PV capital grant programmes and field trials in operation across the UK to stimulate the use of PV in the domestic and non-domestic sectors. DBERR, (formerly the DTI) launched the 'Major PV Demonstration Programme' in 2002 which supported small and medium scale (1kWp-100kWp) PV installations by individual homeowners, businesses and public housing bodies. This was replaced by the Low Carbon Buildings Programme in 2006. DBERR also supported the

domestic and large scale 'PV Field Trials' which was a precursor to the MDP and monitored solar PV systems to measure their effectiveness.

1.5 PV in social housing

The generation of renewable energy from solar PV on social housing could therefore make an important contribution to meeting national carbon reduction targets and addressing fuel poverty for low income tenants by reducing the need to buy grid electricity. In addition, there is the potential to exploit roof space for energy generation. It is also possible that individuals, who perhaps do not normally think about energy generation, will become more aware of where energy comes from. Social housing is rented accommodation provided by councils and housing associations below market house prices for people on lower incomes (Bahaj and James, 2006). As part of Local Agenda 21 and the government's sustainable communities agenda, social landlords have a responsibility for adopting sustainable building practices (Wheal, 2002). This is regulated by the Housing Corporation, which requires new build and refurbished houses to achieve a minimum standard assessment procedure (SAP) energy rating through green policies. The use of PV and other micro-generation systems is also encouraged as this helps to achieve a better SAP rating.

Solar PV systems have been installed by a number of social housing providers and local authorities across the UK such as the Peabody Trust (across London) and Kirklees Metropolitan Council. Kirklees has installed solar power on a relatively large scale providing 304kWp of solar power on 500 homes (Building for a Future, 2006). Nevertheless, solar PV is still not widespread in UK social housing.

1.6 Renewables and social science

Bearing in mind the current emphasis on community engagement (outlined in section 1.3) in UK energy policy, it follows that public perceptions of renewable energy in the UK needs to be addressed if these strategies are to be a success. For instance, it can be

argued that without public acceptance it will be difficult to overcome potential barriers to change and to diffuse RETs.

Public attitudes toward solar power have been investigated by large scale government commissioned polls (e.g. DBERR, 2007); however, Faires and Neame (2006) suggest the need for integrated theories of consumer adoption behaviour. Whilst highlighting the complexities of defining who the public are, Walker (1995 p49) argued that “a clearer and more sensitive understanding” of public attitudes and how they are formed and developed is required. In a review of public attitudes to renewable energy, he further argues that perceptual and social dimensions have been ignored and that attitudes to energy policy and energy generation are variable and often contradictory.

Psychological, social and cultural factors are increasingly recognised as important for understanding the public’s expectations of and interactions with RETs and their subsequent effective implementation. This is reflected in a growing body of academic arguments that suggest a multi-disciplinary approach is useful in understanding the socio-technical system of energy supply (e.g. Egan, 2001; Shove, Lutzenheiser, Guy, Hackett, and Wilhite, 1998; Roy, Caird and Potter, 2007; Strang, 1997).

Devine-Wright (2005 p59) suggests that:

the increasing prevalence of smaller scale, embedded or distributed power systems using local energy resources, is resulting in a greater importance associated with non-technical, specifically social and psychological aspects, of energy generation, supply and consumption such as social capital and community involvement.

Furthermore, Strang (1997), in noting how energy research has been traditionally dominated by engineering and economic rationality models, suggests that:

elusive issues – for example, roles and identity and the development of cultural values – are being drawn to the surface, making visible some of the important relationships between the socio-cultural , economic and technical aspects of energy use (Strang, 1997 p2).

Related to this, Uzzell, Pol and Badenas (2002) assert that understanding the social and psychological aspects of specific localities is important for advancing policy for sustainable development. They suggest that:

Sustainability is neither a vision nor an alterable state but a creative and local process of searching for balance that spreads into all areas of urban management and decision making. As every city is different, each city must find its own way toward sustainability. (Ibid. p 27)

This was the tenet of the Local Agenda 21 policy and these researchers suggest the need to study different types of communities and neighbourhoods individually in order to disentangle the social and psychological processes affecting environmental values and behaviours distinctive to the area of study.

1.7 Research context

This was an Engineering and Physical Sciences Research Council (EPSRC) industrial CASE studentship, funded through the Integration of New and Renewable Energy in Buildings (INREB) Faraday Partnership. The industrial sponsor was the environmental charity Groundwork Leicester and Leicestershire ([GWLL], formerly known as Environ). GWLL has been responsible for a number of energy efficiency and renewable energy projects in the Leicestershire area. The thesis examines a neighbourhood renewable energy project called the ‘Solar Streets’ project in Leicester, UK from a social-psychological perspective.

The 'Solar Streets' project was managed by GWLL who obtained £321 042 from the DTI PV major demonstration programme. This programme supports medium scale (5kWp – 100kWp) solar photovoltaic installations. Total cost of the project was £450 000 and further money was obtained from Braunstone Community Association (BCA) who received and managed a £56 million New Deal for Communities grant for regenerating North Braunstone; Leicester Housing association (who carried out refurbishment of 217 houses in a 'Six Streets' area) and the Neighbourhood Renewal Fund (NRF). The NRF is a government grant available for England's most deprived authorities to help improve them (Communities and Local Government, 2008). A partnership was formed between these organisations and they met regularly to discuss the implementation process of the PV panels on 50 homes in the area. The researcher attended monthly meetings with the organisations involved in the project (BCA, Environ, LHA, NRF) from September 2003 and was therefore privy to information regarding project start up and problems with the installation process. For example, a number of meter changes needed to be made in setting up the PV systems and access to the homes proved to be difficult. This made getting the systems installed and commissioned a protracted process.

The 'Solar Streets' project installed a total of 52 kWp of solar photovoltaics. Grid-connected PV systems were installed on 45 existing properties and five new build properties in the 'Six Streets' area with the aim of reducing tenants' fuel bills and carbon emissions. Each house was selected because it was south facing, therefore giving the best exposure to the sun's rays, and fitted with Redland PV800 polycrystalline roof tiles which clip together to form a large PV module (see figure 1.1). Sundog Energy Limited was contracted for this project and was responsible for the installation of the PV systems. A local resident on the 'Six Streets' estate installed the PV roof tiles. The 'Solar Streets' project therefore went some way to providing employment in the area. The PV systems integrate with the existing roof tiles and are connected to a 'Sunny Boy' inverter and were also installed by Sundog, most typically in the attic of each home (see figure 1.2). This is an electronic device that converts the output of the solar array into mains electricity. This allows it to be safely used in the house or exported to the National

Grid. The roof module is also connected to an analogue meter in the house which shows the amount of free electricity produced by the PV array. All of this information was collated in a leaflet given to each resident (see Appendix 7).



Figure 1.1 PV system on the roof of an LHA property



Figure 1.2 Sunny Boy inverter

As well as the physical aspects of the installation, (i.e. the installation of the tiles and the inverters) the PV project meant a change to a new electricity provider. The electricity provider used for the project was 'Ecotricity'. Ecotricity was used because it invests in renewable energy generation and because of their involvement in other community projects. Because many of the residents had prepayment meters, Ecotricity was

responsible for swapping over the prepayment meters and fitting each PV house with a credit meter.

Tenants benefit from free solar electricity whenever electricity generated from the PV is offsetting domestic consumption. This is when the sun is shining or when there is daylight. How much tenants benefit will depend on lifestyle and energy use within each house. It was decided amongst the management team that any surplus electricity not used by the tenants would be sold to the National Grid and that this money earned would be put into a community trust fund and used for energy saving measures in homes across the Braunstone estate. This was with the aim of enabling the wider community to benefit from the project, not just the individual PV homes. BCA worked closely with Ecotricity to set this up. This meant that battery storage (which would store surplus solar electricity for use outside of daylight hours) was not considered as an option for this particular PV project.

This on grid system of selling electricity back to the grid was implemented in this way because it is most typical in the UK and other European countries where utilities are obliged to buy back surplus electricity so that house owners are rewarded for generating their own electricity. This is different to battery storage which stores the PV electricity so that it can be used outside of daylight hours and in winter.

1.7.1 Braunstone

The site for the case study is the residential area of Braunstone, which is an outer city estate, located three miles west of Leicester city centre. The Braunstone estate was built in the 1930s in order to move people away from city centre slum houses. Up until the 'right to buy' legislation of the Thatcher era, the local authority owned and managed all of Braunstone's housing stock, schools and allotments. North Braunstone has a population of 14, 981, as measured by the 2001 Census, and is regarded as one of the most deprived wards across the UK (Leicestershire County Council [LCC], 2001). As a

result it has typically been subject to a variety of socially related problems. For example, crime is one and a half times the national rate, teenage pregnancy is twice that of the city’s average. Table 1.1 provides an outline of the socio-demographic profile of the area.

Table 1.1 Socio-demographic characteristics of Braunstone

Socio-demographic characteristic	
Population	14, 981 (LCC, 2001)
Ethnic Origin	White: 89.3% , Other: 10.7% (LCC, 2001)
Mean Age	38.1 (LCC, 2001)
Employment	Employed (aged 16-74): 67.8% (LCC, 2001) In 1999, approximately 40% of population on income support (GOEM, 2007)
Education	No qualifications/highest qualification level 1/other qualifications/unknown: 59.6% (LCC, 2001)
Mortality Rate	Highest in Leicester in 1999 (GOEM, 2007)
Crime rate	High crime rate, particularly burglary (GOEM, 2007)
Comparable level of deprivation	In 2000, Braunstone was ranked the second most deprived area in England in the DETR Index of Deprivation (EMRA, 2000).

Twenty one per cent of UK housing is provided by social rented sector provision and of this, seven per cent is rented from housing associations (ONS, 2004). Of north Braunstone’s concentration of social housing, 210 properties spanning a ‘six streets’ area were sold by the local authority to Leicester Housing Association (LHA) in 2002 after residents grouped together to vote opposing demolition of these properties. The properties were blighted by a demolition proposal as a result of high disconnection from the area by residents due to vandalism, drug use and bad housing conditions. LHA was involved in refurbishing the 217 houses and introducing noticeable physical neighbourhood improvements such as new pavements, trees, and green spaces for neighbourhood use. The refurbishment which has modernised the housing stock is helping to eradicate Braunstone’s air of dilapidation illustrated in Figure 1.3.



Figure 1.3 Front cover of the 'Braunstone News'

This neighbourhood regeneration is part of substantial investment in the area following the government's 1998 'New Deal for Communities' funding programme for locally delivered initiatives. The strategy seeks to address employment, health, crime and educational issues in "deprived" areas:

The programme aims to bridge the gap between some of the poorest members of our society and the rest of Britain. By focusing resources on small deprived areas and dovetailing its work with other initiatives operating in the area, it seeks to achieve maximum impact (Department for Transport, 2004 p1).

Although the New Deal fund was used for initiatives in the area to improve the social and physical environment and residents were consulted on how the money should be spent, the way BCA managed the fund came under criticism from Braunstone residents.

This therefore provides a backdrop to the 'Solar Streets' project in that the introduction of schemes to improve the area (such as the PV project) led to tensions across the Braunstone neighbourhood. It is feasible that these place-related issues may be important when considering factors affecting attitudes towards and perceptions of solar PV and this is in part why psychological theories of place attachment and place identity (as described in Chapter 4 of this thesis) were invoked for this case study.

1.8 Aims and Objectives

The aim of this thesis is to examine social and psychological aspects of solar PV installed on a social housing estate. More specifically, it aimed to better understand low income tenants' perceptions of and attitudes towards solar PV and whether or not social and physical characteristics of the research context influenced participants' attitudes and perceptions.

In order to do this, the research drew on frameworks provided by diffusion of innovations theory (DIT) and place-related social identity (PRSI) theory. These theories were used as a template to analyse participants' accounts. As such, a theoretical aim of the thesis was to examine how well the theories explain participants' attitudes towards and perceptions of PV. A further theoretical aim was to see if there were factors that influenced people's perceptions of and attitudes towards the PV and the PV project that were not accounted for by either of the two chosen theories and therefore, whether other psychology theories could provide further understanding of the research problem.

In order to determine the social and psychological factors influencing attitudes to PV and the Braunstone Solar Streets Project, the research was designed to explore the following questions that were based on concepts discussed in the theoretical framework Chapters 2-4 of this thesis.

- 1) Does interpersonal communication across social networks influence attitudes to PV? (DIT, Chapter 2).

- 2a) Do tenants' perceptions of PV relate to the conceptualisation of perceived innovation attributes: relative advantage, complexity, compatibility, trialability, observability and risk? (DIT, Chapter 2).

2b) To what extent is relative advantage linked to the perceived financial benefit to the household of the PV panels?

2c) To what extent do basic aspects of living with PV such as changing from a card (pre payment) meter to a credit meter and changing to a new electricity supplier affect attitudes to PV? (DIT, Chapter 2).

3a) To what extent are perceptions and attitudes towards PV influenced by perceptions of place?

3b) To what extent are perceptions and attitudes towards place influenced by PV?

4) Do issues of environmental concern relate to tenants' beliefs about PV?

5) Do tenants' perceptions and attitudes towards PV change over time, (from pre installation phase to post installation phase).

A qualitative approach was taken for the main phase of the study to gather data on responses to PV and the PV project prior to installation. A questionnaire survey was used three years later to explore the question of whether attitudes towards and perceptions of PV had changed over time.

1.9 Overview of thesis

Chapter 2. Diffusion theory – This first literature review chapter presents a review of empirical research (Rogers, 2003) investigating attitudes to solar technology in the 1970s using DIT. Concepts from DIT are introduced and the rationale for its use in this thesis is explained.

Chapter 3. Contemporary social RET research - Non-diffusion studies investigating attitudes to RETs are discussed which suggest that other theoretical frameworks may provide insights into attitudes towards and perceptions of solar PV.

Chapter 4. Place theory – Different traditions that have studied human-place relationships are first described, followed by a theoretical review of place literature that has explored the psychological processes of individual's relationships with their social and physical environment. Studies are presented that have used place theories in understanding attitudes to environmental issues. The chapter concludes by setting out the framework for understanding place issues potentially relevant to understanding perceptions of and attitudes towards of PV.

Chapter 5. Research methodology - This chapter presents the epistemology, methodology and methods used to investigate the research problem. The epistemological stance underpinning this empirical study is first discussed. The research questions that informed the research strategy are then repeated. The chapter goes on to explain the research methodology by detailing how the pilot, main interview study, questionnaire survey and data analysis were undertaken.

Chapters 6-8. Findings - The main themes arising template analysis of 42 semi-structured interviews (study 1) are presented and discussed. These are structured under three chapter headings: Findings: energy awareness; Findings: place; Findings: technology diffusion.

Chapter 9. Study 2 - Presents results and discussion from study 2 which was undertaken three years after the main interview study.

Chapter 10. General discussion - Discusses the four findings and results chapters in light of the literature presented in Chapters 2-4 and reflects on the usefulness of DIT and PRSI in understanding perceptions of and attitudes towards PV.

Chapter 11. Conclusions - The significance of the reflections from the general discussion for practical aspects of RET projects are outlined. Theoretical implications from the conclusions are also made.

2 Diffusion Theory

2.1 Introduction

In order to examine the social and psychological factors potentially relevant to a neighbourhood RET project, a comprehensive literature review was undertaken of social research on solar energy systems. This was conducted with the aims of assessing:

- Which social and psychological factors have affected attitudes towards and perceptions of solar energy technology?
- Which theories have been applied in understanding attitudes towards and perceptions of solar energy?
- How the theories and their constructs have been defined?
- Which methods have been applied in this area?

This revealed that much of the literature highlights attitudes and assessments of technical and financial aspects of installing solar technology in the social literature (e.g. Sawyer and Wirtshafter, 1985; Klein, 1983) and also that a body of research on attitudes to solar technology has been carried out within the framework of DIT which is attributed to Rogers and Shoemaker (1971). DIT is a theory of social change concerned with how quickly an innovation is adopted by society. More recently there have been revised editions of the theory (Rogers, 1983; 1995 and 2003). On this basis, it is useful to look firstly at the basic characteristics of DIT as set out by Rogers (2003). This will be achieved by first presenting a broad overview of DIT and then showing how specific aspects of the diffusion model have been applied in understanding attitudes towards and perceptions of solar technology.

Following a description of the theory, the review aims to synthesise a body of research focusing on social and psychological aspects of solar technology in the domestic sector. More specifically it looks at perceptions of solar technology amongst homeowners using DIT and Rogers' 'attribute-perception' model (2003) (originally based on empirical

work by Rogers and Shoemaker 1971). The objective is to demonstrate how DIT has been applied to solar research since the 1970s.

2.2 Diffusion of innovations theory (DIT)

DIT has its roots in rural sociology at a time when researchers were interested in why corn farmers in the USA adopted a new farming practice and others did not. Since then it has been applied widely across disciplines such as anthropology, communication studies and marketing where researchers have been interested in understanding the factors that affect the adoption of an innovation. DIT therefore is a general theory applied to the study of a large number of different innovations, such as solar energy systems.

Diffusion refers to the process of how an innovation or idea is communicated through society over time via interpersonal contacts involved in exchange of information. The concept of diffusion has been defined by Rogers (2003 p5) as:

the process by which an innovation is communicated through certain channels over time among the members of a social system.

Where an innovation is:

an idea, practice or object that is perceived as new by an individual or other unit of adoption (Rogers, 2003 p12).

Rate of diffusion is expressed as the time it takes for an innovation to reach a percentage of the population (Rogers, 2003). As the innovation is communicated it can be adopted or rejected. Adoption refers to the up-take of the innovation whereby people will adopt the technology or reject it according to their level of innovativeness and other factors such as the perceived characteristics of the innovation. When time is plotted on a graph against the number of people adopting, the rate of adoption follows an s-shaped curve as

shown in Figure 2.1. The figure represents the cumulative number of people who have adopted at a particular time and the spread of the innovation.

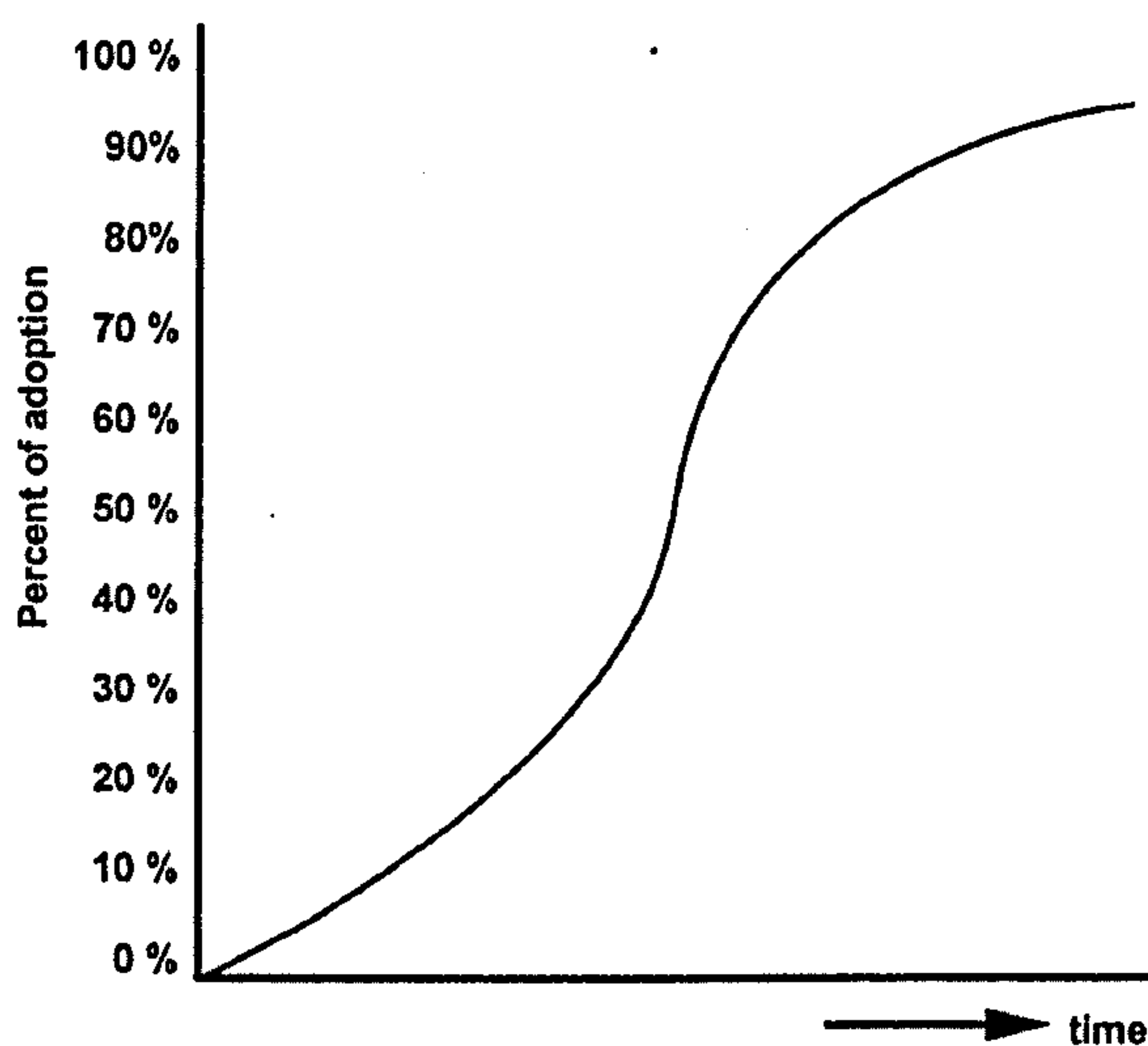


Figure 2.1 S-shaped curve of adoption

The degree to which an individual is earlier in adopting new ideas, in comparison to other members in a social system, defines the concept of innovativeness and is dependent on personal characteristics. There are five stages of innovativeness that individuals can exhibit that correspond to the s-shaped path described above: 1) innovators, (adopt first); 2) early adopters; 3) early majority; 4) late majority; 5) laggards (last to adopt). Wisenbilt (1981) and Lebay and Kinnear (1981) argue that the concept of innovativeness is both: 1) an innate hypothetical construct (innovativeness is hypothesized as being an inherent human characteristic); and 2) measurable as depending on time. The s-shaped curve above illustrates that adoption accelerates when the majority accepts the idea and declines after the majority have accepted. From this point onwards laggards are left to adopt (Ibid.). DIT research typically examines what impedes and facilitates adoption and what influences its speed. Although some diffusion studies have looked at adoption of PV systems, i.e. to understand how adoption of an innovative, decentralised electricity system will become more widespread across

countries (e.g. Faires and Neame, 2006; Hackstock, Ornetzeder, Hubacek and Kashtner 1995 and Kaplan, 1999), these research questions of how PV adoption is stimulated are not applicable to the Braunstone research context. This is because the decision to adopt PV has already been made on behalf of the tenants in solar homes, therefore, rate of adoption is not the variable of interest. However, this literature review goes on to show that this does not prevent DIT from being a useful framework within which to examine perceptions and attitudes of PV amongst social housing tenants.

2.2.1 The innovation-decision process

The innovation-decision process is suggested by Rogers (2003) to be the psychological process in which an individual learns about an innovation, forms an attitude towards it and then decides whether to adopt or reject it. Rogers (Ibid.) suggests that the process is characterised by the five sequential stages below.

- Knowledge
- Persuasion (forming of a favourable or unfavourable attitude towards it)
- Decision to adopt
- Implementation
- Confirmation

Adoption involves communication of information at the knowledge and persuasion stages. Implementation refers to the use of the innovation and this is then followed by confirmation of the decision, which is the last part of the process. The steps of the process occur in an ordered sequence over time whereby adoption usually follows persuasion. An exception to this usual sequence may be that the decision stage precedes the persuasion stage. Rogers (2003) describes different types of innovation decision. An optional innovation decision is where an individual decides whether or not to adopt independent of other people. In contrast, an authority decision is a decision made on behalf of individuals by a powerful few, such as a government (e.g. Rogers, 2003 uses the example of use of seat belts in the UK). Importantly, this is the case in the current

research where an authority decision has been made on behalf of the PV householders by the organisations involved in running the project. Authority decisions are usually made by a change agent, who foresees positive consequences of making this decision. Rogers (2003) suggests that the change agent should be sensitive to the needs of the targets of the decision. For instance, in the context of Braunstone, the PV project managers foresaw the benefits of the project in terms of reducing fuel poverty, of helping reduce carbon emissions and of raising awareness of RETs. However, change agents cannot accurately know the outcomes of adoption in terms of what people's subjective perception of the innovation will be.

Rogers (2003 p172) says:

the innovation decision process is essentially an information seeking and information-processing activity in which an individual is motivated to reduce uncertainty about the advantages and disadvantages of the innovation.

This process of information gathering, Rogers suggests, can be summarised in the following questions that people typically ask of an innovation:

- What is it?
- How does it work?
- Why does it work?
- What are the innovations consequences?
- What will its advantages and disadvantages be in my situation?

Overall, four key elements of diffusion can be discerned from the description above and have been the focus for diffusion researchers. These are:

1. An innovation: an idea practice or object that is perceived as new by the individual adopting it.

2. Communication channels: Rogers (2003) suggests that this is how information regarding the innovation reaches individuals and groups. Communication may be via mass media or interpersonal channels. Mass media is more important for knowledge and awareness of a new innovation whereas interpersonal networks are important for communication/persuasion. Information exchange involves a communication channel connecting two units (actors), one that has experienced the innovation and one that has not. The channel “is the means by which messages get from one individual to another” (Rogers, 2003 p18). Sharing information is a key part of the diffusion process.

Diffusion researchers have used network analysis to measure the influence of communication on adoption. Within network analysis, ‘homophily’ is the tendency to communicate with people who are similar to you in characteristics such as beliefs and social status. Homophilious communication tends to take place in groups that are alike, for example amongst people that live or work near each other. In contrast, ‘heterophily’ refers to communication amongst people who are dissimilar. Rogers (2003) says that heterophilious communication is necessary for communication of innovations in order for technically oriented innovators to spread information to individuals at later stages of innovativeness. However, this can be difficult given the homophilious nature of many relationships. The influence of homophily is highlighted by Rogers (2003) discussion of Kaplan’s (1999) study of communication via electricity utilities in the adoption of PV. Rogers says that:

Most individuals do not evaluate an innovation solely or perhaps at all on the basis of its performance as judged by scientific research. Rather, they decide whether or not to adopt on the basis of the subjective evaluations of the innovators conveyed to them by others like themselves (peers). Rogers (2003 p247).

3. Time: refers to a) the decision process an individual undergoes in adopting or rejecting the innovation; b) how early or late the innovation is adopted; c) rate of adoption, usually measured by how many individuals in a social system adopt in a given time period.
4. Social system: defined as “a set of interrelated units that are engaged in joint problem solving to accomplish a common goal” (Rogers, 2003 p32). The members or units of a social system “may be individuals, informal groups, organisations, and/or subsystems.” (Rogers, 2003 p23). Just like an innovation itself, a social system is bounded. The structure of this bounded system affects diffusion. Each social system can have change agents and opinion leaders and the system affects diffusion. As well as individual characteristics, the social structure of members in a social system acts as a boundary that the innovation must diffuse through; such as vertical (heterophilious), or horizontal (homophilious) relationships. Underlying the social system is a communication system between actors (Ibid.).

As Tajfel (1978) points out, the relationship between individual and society is the central problem of social psychology and it is noteworthy that the fourth element of DIT has links with the unit of analysis in social psychology. Therefore, although DIT has individualistic implications (e.g. such as decision making involved in adoption), it is also a social theory concerned with change across, and within, social systems.

2.3 Attribute-perception model

Some innovations take longer than others to diffuse. Some, even those that succeed, take decades, and some do not successfully diffuse at all. For example, cell phones in comparison to videocassette recorders took only a few years to be adopted. Importantly, what someone thinks about the innovation can help explain the different rates of adoption. This is where the attribute-perception model may be applied. The attribute-perception model is a list of five characteristics an innovation has, that the adopter or the

person perceiving the innovation makes a judgement on in order to make an adoption decision. As Roy, Caird and Potter (2007) point out, these perceived characteristics tend to vary in degree depending on a range of psychological, technical and sociological factors, such as system reliability and complexity, how observable the results of the innovation are to others, and values.

These five characteristics as conceptualised by Rogers and Shoemaker (1971) were used in the aftermath of the 1970s fuel crises by researchers studying attitudes and perceptions towards using renewable energy and the model has been replicated in subsequent empirical research. The five characteristics have been defined by Rogers (2003) as follows:

1. **Relative Advantage:** the degree to which an innovation is perceived as being better than the idea that precedes it. This can be measured in a) economic terms; b) social prestige; c) convenience; d) satisfaction. For tenants in Braunstone, this may relate to the potential saving to be made in economic terms.
2. **Compatibility:** the degree to which an innovation is perceived to be consistent with the potential adopter's values, needs and past experiences. Rogers (1995) uses the example of use of contraceptives in religious countries which is seen as inconsistent with values. Diffusion is therefore slow if it happens at all.
3. **Complexity:** how easy or difficult the innovation is to understand or use.
4. **Trialability:** the degree to which an innovation may be tried or experimented with on a limited basis before it is purchased or taken on.
5. **Observability:** the visibility of the results of the innovation. Observability stimulates discussion as people ask others how they evaluate it. The example used by Rogers (1995) for observability is his study of the adoption of solar water heaters in California. Rogers found that solar water heaters typically appear as highly visible in clusters of neighbourhoods therefore showing that adoption was spatial.

There is the addition of a sixth perceived attribute of an innovation which is ‘risk’ that is presented in the research findings of 1970s social solar thermal studies. Following Bauer (1960), Guagnano, Hawkes, Acredolo, and White (1986 p49) define risk in their study of solar adopters as the “expected probability of economic, personal or social problems resulting from adoption”.

Rogers and Shoemaker (1971) found that adopters, compared to non-adopters, rate an innovation as higher in relative advantage, compatibility, trialability and observability, and lower in perceived risks and complexity. Adoption has also been found to be associated with demographic variables such as age and income. Faires and Neame (2006) suggest that the five attribute-perceptions both convey information; usually around the knowledge stage of the five stages of an adoption-decision process, and provide the motivation needed to adopt or reject an innovation. The six attribute-perceptions are summarised in Table 2.1.

Table 2.1 Six innovation characteristics

Attribute	Description
Relative advantage	The degree to which an innovation is perceived as being better than the idea that precedes it.
Compatibility	The degree to which an innovation is perceived to be consistent with potential adopters’ values, needs and past experiences.
Complexity	How easy or difficult the innovation is to understand or use.
Trialability	The degree to which an innovation may be tried or experimented with on a limited basis before its purchased or taken on.
Observability	How visible the results of the innovation are to others.
Risk (Bauer, 1960, cited by Guagnano et al., 1986)	The probability of product, economic or social problems arising from adoption.

2.4 Application to Braunstone

From this description of the theory, it can be seen that diffusion is concerned with the spread of an innovation through a social system. The theory also considers social and psychological factors involved in adoption, and as such, it provides a valuable framework for considering the acceptance of a new renewable energy technology in Braunstone. It also suggests that attitudes to the solar PV in Braunstone will not just depend on individuals but may be affected by interpersonal networks. A model showing the factors that affect rate of adoption is shown in Figure 2.2. The authority type of innovation decision is shaded in grey to emphasise the type of adoption decision made in implementing the PV project.

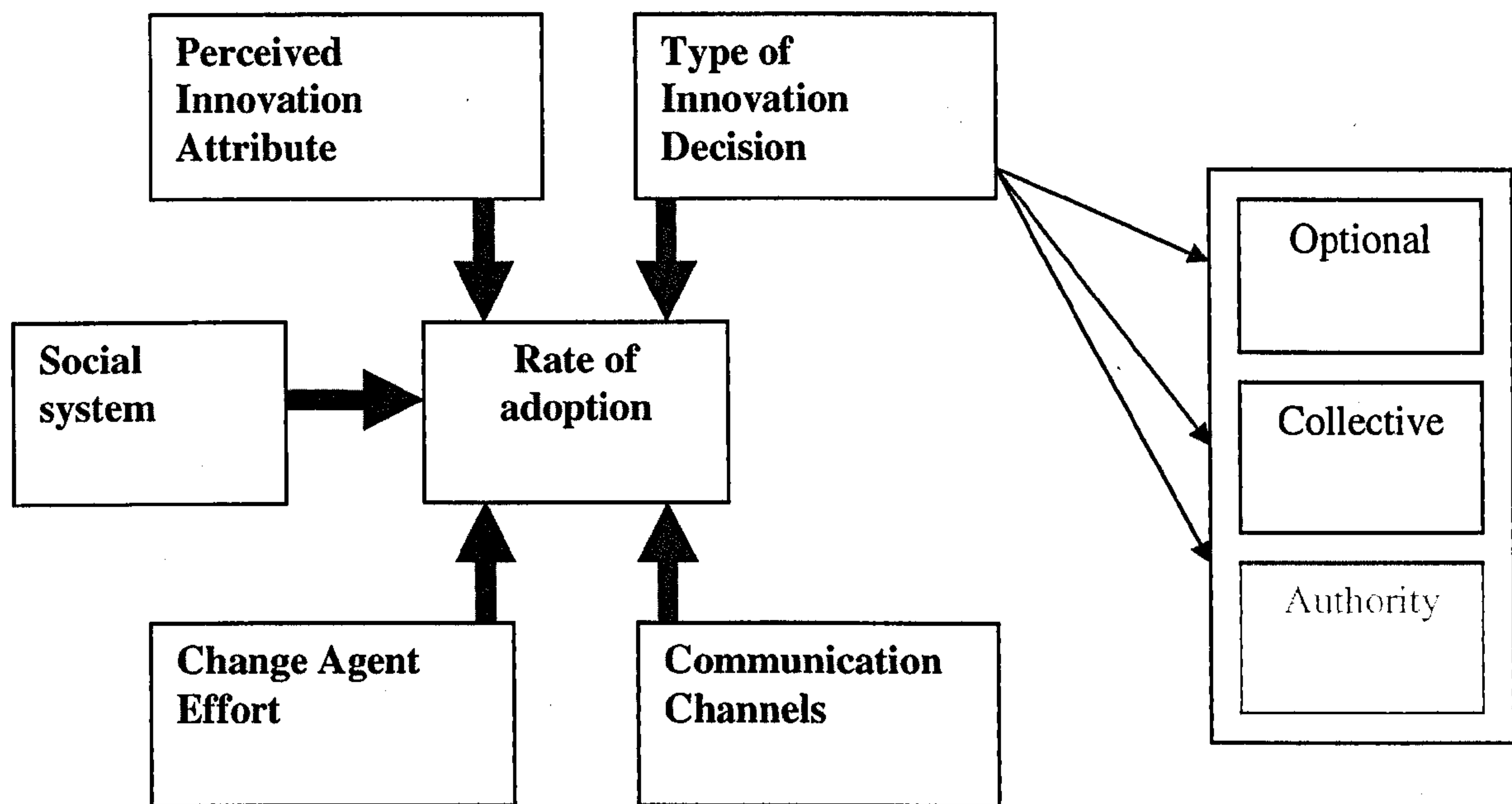


Figure 2.2 Model of adoption (adapted from McGriff, 2001; Jones, Jamieson and Clark, 2003)

Next, in a review of social solar technology research, this chapter provides an analysis of how different researchers have used, or made reference to, DIT and major findings and conclusions from their work. The studies discussed shed light on the role of social networks in DIT and/or have employed the attribute-perception model to understand

attitudes to solar technology. Discussion of these studies will allow for consideration to be made of how useful concepts from DIT (i.e. social networks and aspects of the adoption-decision process) and the attribute-perception model are in illuminating social and psychological factors involved in perception of solar PV in Braunstone.

2.5 Review of empirical studies

Berman and O'Connor (1996) describe how the 1973 oil embargo led to a dramatic increase in public support and enthusiasm for solar hot water heating and solar PV across many sections of American society. Their account explicates links between technical advances of solar technology, the political climate and the supremacy of oil and gas utilities that, they suggest, eventually led to the solar industry's demise during the 1980s. Although it is a partisan source of information, it nevertheless sets a backdrop to the upsurge in research and development of solar and ultimately the body of diffusion research and other exploratory research investigating reliability of solar technology carried out in America during the late 1970s and onwards. Despite public support and the potential of solar technology, social researchers at the time (e.g. Lebay and Kinnear, 1981; Guagnano et al., 1986; Wisenbilt, 1981) noted that adoption of solar technology was nevertheless slow and fragmented.

Research investigating attitudes to solar technology was conducted during this period and focused on first time users' experiences of installing solar equipment. Sawyer and Wirtshafter (1985) described 'typical solar adopters of the period' in America as:

highly educated, predominantly upper income homeowners whose adoption was motivated by a blend of economic, environmental and self sufficiency interests (Sawyer and Wirtshafter, 1985 p58).

Their study of households using face to face surveys in two geographical locations in America and Klein's (1983) study in Germany both assessed homeowners' experiences of technical and financial aspects of solar technology and user satisfaction. In both of the

studies, users gave assessments of system operating troubles, perceived thermal contribution of systems and economic considerations such as payback time through follow-up surveys. Sawyer and Wirtshafter (1985) found overall that respondents were more enthusiastic about the system than their experiences would seem to warrant (i.e. respondents reported high costs and performance problems, yet they also reported high overall satisfaction) which could possibly be due to lenient expectations or cognitive dissonance, whereby if they reported dissatisfaction, then this might lead them to feeling uncomfortable about their purchase decision. Alternatively, the symbolism of 'green' technology may have been a factor affecting a favourable attitude towards expensive and unreliable equipment (assuming that respondents had pro-environmental attitudes).

Other interesting findings in Klein's (1983) study, from a social perspective, relate to his investigation of attitudes towards solar energy and the impact of solar systems on behaviour by seeing whether daily and weekly bathing and laundry habits changed amongst those households in Germany which had installed solar systems. Similarly to Sawyer and Wirtshafter (1985), Klein (1983) conducted a follow up study interviewing 80 households once a year for three years. Additionally he carried out one face to face survey with 380 households. He assessed self-reported behaviour change finding that over 50% of the sample had not changed their behaviour. Five per cent took more showers, but they reported that this was usual behaviour in the summer. Forty per cent changed the time of day that they showered from the morning to the afternoon without any perceived loss of comfort. This raises the issue of demand management in Braunstone and whether tenants will change their behaviour patterns to coincide with the daily electricity profile produced by solar PV.

Klein's (1983) study also found that estimation of whether supply of systems met hot water demand was lower in houses that shared the system with other houses despite collector and storage size being correct per household. This hints at the possibility that social conflict may arise if individuals share solar equipment, but more importantly, asks the question how much of this is perceptual and how much of this is based on real energy consumption patterns? The number of household occupants was a factor

affecting attitudes, illustrating that understanding such attitudes involves complex socio-technical phenomena.

Klein's study (Ibid.) draws attention to occupational status of the sample in noting that 50% had an artisan or technical occupation. He also makes assumptions about gender roles relating to solar equipment, remarking that, "household installations such as solar units are usually the domain of and a challenge to the male family-head interested in technical matters" (Klein 1983 p177). A breakdown of the sample was not provided but it may therefore have been that mainly men were surveyed and interviewed. In the study site for this research, by contrast, solar PV tenants are predominantly female.

Klein (1983) raises some interesting issues but his description of the methodology and findings of this study are questionable given that Klein remarks that 315 out of 380 surveys "were worth evaluating" (p171) and also that he reports no protocol for any qualitative or quantitative data analysis. Furthermore, the results are presented with no indication of which sample they relate to. Links are made between support for solar technology, dislike of nuclear energy and American utilities' monopolisation of the solar market that are not tested empirically, but perhaps more reflect the author's preconceptions. Following Sawyer and Wirtshafter (1985), validity of follow-up surveys in both of these studies is questionable because those who responded are a biased subset of the initial sample and strong emotional and financial commitments to solar systems may bias responses.

2.6 The social system

From a description of the four elements of DIT (in section 2.2.1), it can be seen that DIT places emphasis on the social context as much as the individual decision-making and the characteristics of the adopter, and that social networks and peer to peer communication are important in DIT.

A study by Rogers and Kincaid (1981) as cited in Rogers (1983) emphasises diffusion as a social process and the importance of the nature of the social system. They investigated diffusion of various contraceptive methods in villages in South Korea and found that although women were matched on individual characteristics, adoption of contraception diffused at different levels with different types (of contraceptives). Rogers suggests that system norms based on culturally accepted patterns of behaviour determine to some extent how people evaluate an innovation.

Studying local practices has become recognised as better practice compared to the traditional approach of top-down intervention for successful implementation of renewable energy programmes (e.g. Devine-Wright, 2005; Schweizer-Reis et al., 2001; Uzzell et al., 2002). This echoes work on the social psychology of communities and participation (Campbell and Jovchelovitch, 2000; Gilchrist, 2004) which employs social psychological theories such as social identity and place identity to examine community processes and practices in order to assess barriers and incentives for successful pathways to community change. Discussion of these theories follows in Chapter 4.

Social norms have also been found to affect public perceptions of energy infrastructure. In a study investigating the role of social interaction in shaping perceptions of a new wind development in South Wales (UK), Devine-Wright and Devine-Wright (unpublished) investigate communication within social networks of an ex-mining community in an empirical study of beliefs and behaviour surrounding support for a community wind farm. They define 'normative influences' as the influence of others such as friends and family on private beliefs and actions. These are compared with the

impact of public participation in assessing support for the wind farm. The results suggested that the social context was an influence beyond participation, not only in shaping beliefs about the wind farm, but also in influencing voting behaviour in a referendum.

Where Rogers (2003) uses the term 'actors', Hackstock, et al., (1995) define the concept 'relevant social actors' as informal or formal groups, institutions or individuals who are involved in the diffusion of a technology via a social process. The research stemmed from the recognition of a "non-conventional technology transfer process" (Hackstock et al., 1995 p1) which relates to a sharp increase in diffusion of solar hot water heaters in Austria amongst committed self-construction groups, despite the lack of popularity for solar following a drop in political and economic support for solar energy in Austria in 1986. This happened initially on the basis of communication via interpersonal networks and highlights the strength of word of mouth reports in promoting support for solar technology. Subsequent to this, support then led to communication via mass media channels. In addition, this study, like Klein's (1983) showed that the social movement interested in solar energy between 1970s and 1990s was characterised by technically-oriented individuals. This is therefore another factor to consider that may affect attitudes to solar PV in Braunstone. In other words, does a predisposition towards technical occupations or hobbies affect attitudes towards and perceptions of PV?

Klein (1983) also notes that technicians who had read articles in technical magazines were a major source of information and that information on installing solar technology also came via 'small special fairs' or through personal or work contacts. This relates to both media and interpersonal communication channels and diffusion networks discussed by Rogers (2003) and Darley and Beniger (1981).

Klein (1983 p179) further suggests that:

considering the occupational structure existing for unit owners, positive experiences among a fairly competent group of users could certainly become one of the best advertising agents for particular models and the technology as a whole.

This points to Rogers' (2003) idea of the barrier that an innovation must diffuse through and how diffusion is dependent on positive experiences of peers. Leonard-Barton (1981 p180) suggests that:

Interpersonal communication channels are especially vulnerable to rumour and to horror stories. Therefore, while solar is now riding the crest of adopter enthusiasm in California, it could crash if solar owners become disillusioned with their equipment. Unfavourable communicated experience is more potent than favourable in influencing people's attitudes toward an innovation.

Interpersonal networks in the above studies are seemingly important in influencing people's attitudes to an innovation. In a working class neighbourhood like Braunstone, social networks have traditionally tended to be thought of as being dense and closely tied. Such a strong sense of community has been thought to be due to occupational, personal and residential immobility of residents, or, the need for reciprocity and self-reliance in order to cope with external pressures (Clark, 2007). It follows from this that if such strong interpersonal ties do actually exist in Braunstone, then the above remark by Leonard-Barton (1981) may be particularly relevant, in that negative perceptions or experiences of solar PV may lead to cynicism across the neighbourhood.

However, notions of neighbourhoods with close social ties have been challenged by recent changes to urban communities due to economic and social factors such as newcomers, and generational changes and gentrification (Clark, 2007; Martin, 2005). This is in fact the case in Braunstone, where social and economic decline has led to changes in the social and physical fabric and subsequent community renewal initiatives (e.g. the Neighbourhood Renewal Fund, New Deal for Communities and Sure Start).

These issues provide a context for considering the influence of Rogers' concept of social networks on attitudes towards and perceptions of PV.

Although beyond the scope of this chapter, it is interesting to note that network analysis, as discussed by Rogers in understanding diffusion of an innovation, is also discussed in research conceptualising notions of community, neighbourhoods, community development and social capital. Definitions of social capital have been considered by many theorists. Putnam's (1993) work, which is widely cited in the social capital literature, suggested that social capital refers to connections among individuals that have value for the individuals involved in the network due to norms of reciprocity and trustworthiness that arise from the connections.

Groups formed by a similar social niche and characterised by close family or friendship ties are suggested within social capital theory to have 'bonding social capital' which acts as a resource with positive consequences for all individuals involved in the network (Field, 2003). Bonding within Rogers' network analysis relates to horizontal (homophilous) links between actors.

Further on the topic of communication between interpersonal networks, Klein (1983) found that owners of solar technology were asked questions by friends, relatives and colleagues particularly in the first few months of ownership. Klein (1983, p179) reports that the "flattering role of the advisor was willingly accepted" and "that in addition, being mounted on an exposed spot, collectors are an unusual sight and lead to questions and comments".

This calls to mind the notion of status and prestige from owning solar thermal systems reported in other studies (e.g. Guagnano et al., 1986). Knapp (2004) also found that a renewable energy system is perceived as a positive status symbol in Austria and Southern Germany. Bahaj and James (2006) categorise pride as an indirect 'softer' benefit of installing solar PV.

These findings also relate to the factors of trialability (although trying PV on a temporary basis is difficult, information was sought about systems from solar householders) and observability (how visible the results of the solar technology were to others) in Rogers' (2003) attribute-perception model. This raises the question of what are the implications for sense of pride and prestige from PV installation amongst low-income tenants on a social housing estate?

Another interesting social impact of solar technology is discussed by Klein (1983 p180), in that solar systems, being a relatively new technology, may be off putting to people in that it might "scare people away from an activity which also implies an exposure within their social surroundings". This comment not only relates to observability of solar, but also to the uncertainty and social and psychological risks associated with adoption of solar systems, as summed up by Wisenbilt (1981 p100) in raising the question "will the choice of a solar system result in embarrassment before others and bruise the solar adopters' ego?"

In a discussion of the application of DIT, Egan (2001) emphasises the importance of communication channels and social systems in acceptance of an innovation in a review of models that have attempted to apply social theory to energy use.

So far, this chapter has set out that Rogers' (2003) theory is an integrated attempt to explain a number of different facets of diffusion which considers both the aspects of an innovation and the cultural and social aspects of its social context. As such, this has more merit than the rational choice model of energy research which suggests that behaviour is driven by simple linear (economic) drivers, i.e. the motivation to maximise utility. Another limitation of the rational choice model is that it considers purchase decisions and behaviours at the individual or household level of analysis (Strang, 1997). Strang (Ibid.) suggests that this approach to energy research misses out on potential contextual explanatory factors. This argument is echoed by a number of sociologists and psychologists who have identified that human aspects of energy is underpinned by varied motivations (e.g. Crosbie, 2006; Murphy, 2007; Roy, Caird and Potter, 2007).

Critical reflection on DIT is provided by Shove et al. (1998) who are dismissive of its use in social research. They suggest that analysing the trajectory of technology using the diffusion model oversimplifies the human complexities and contextual influences on energy-use behaviours and adoption of energy efficiency measures.

Shove's comments are suggestive of the diversity of human energy behaviour. However, DIT makes quantifiable, well-tested generalisations that can be used as a basis for tackling aspects of the psychology and sociology of energy behaviour and the theory at least attempts to provide a wide-ranging and coherent framework for understanding attitudes and perceptions of an innovation.

The solar research reviewed so far has highlighted that diffusion of an innovation depends on communication and that the majority of adopters are dependent on reports from adopters earlier in the decision making process. For example, Sawyer and Wirtshafter (1985) and Klein (1983) argue that attitudes of peers are important in encouraging adopters. In addition, Klein (Ibid.) and Hackstock et al. (1995) highlight mass media (magazines) as well as interpersonal connections in their studies. This points to the consideration of the social context and social relations in the case study investigated by this research. Who is friends with whom; whether people talk to their neighbours or not; is the network very close knit or not? Does local media influence tenants' awareness of PV? The studies presented also suggest that performance and reliability may affect attitudes towards solar technology, but that perceived performance may be influenced by social factors such as group or household composition.

2.7 Empirical research using Rogers' attribute perception model

The remainder of this literature review of social solar technology research focuses on conceptualisations of the six attribute-perceptions described in section 2.3. This will involve an analysis of how different researchers have used the attribute-perception model, and major findings and conclusions from their work. Then consideration will be made of how useful DIT and the attribute-perception model are in illuminating social and psychological factors involved in perception of solar PV in Braunstone.

Lebay and Kinnear (1981) and Guagnano et al. (1986) used the attribute model to investigate differences in attitudes to solar thermal technology between three adopter groups: 1) adopters; 2) 'procrastinators' (knowledgeable non-adopters); and 3) general public.

Lebay and Kinnear (1981) used chi squared statistical tests to analyse survey data from 631 residents of the state of Maine and found, like Rogers and Shoemaker (1971), that there were no statistically significant differences between adopters and procrastinators on demographic characteristics and also, that compared to non-adopters: adopters were younger; more highly educated; had higher incomes; were "earlier in the family cycle" and had "higher occupational status" (Lebay and Kinnear, 1981 p274). This suggests that social housing participants in the present case study site may have a different socio-demographic profile to voluntary innovators.

Findings relating to the application of the attribute-perception model were also consistent with Rogers and Shoemaker's (1971) results. Adopters differed from the general public in rating solar equipment as higher in relative advantage, more compatible with their values, less socially and financially risky and less complex. Findings that were not consistent were that adopters regarded solar energy systems as less observable and less easy to try. This leads the researchers to suggest that the attribute-perception framework should be modified for future use because trialability of solar technology is difficult. Wisenbilt (1981) however, suggests that there is scope for

further understanding of the role and perception of demonstration programmes as a factor in trialability of solar technology and concludes in a review that “future research of individuals’ perceptions of solar energy innovations should further utilize the perceived innovation attributes framework.” (Wisenbilt, 1981 p105); thereby advocating use of the diffusion attribute-perception framework. Similarly, Leonard-Barton (1981) discusses the potential for occupiers of homes of solar technology to provide demonstrations, as was the case in America with some volunteering adopters at that time.

In the UK, Murrell (2001) used a questionnaire to look at attitudes to PV amongst 120 community stakeholders in Surrey, UK and also found some evidence for demonstration projects creating a positive attitude towards PV.

Darley and Beniger (1981) discuss the merits of Rogers’ five factors (the six attribute-perceptions defined above, not including risk) as determinants of the decision to adopt energy conservation behaviours and, like Lebay and Kinnear (1981), who suggested revising the model, suggest that the attribute-perception model is too simplistic if considering energy-saving behaviours. Following a review of psychological studies of adoption they restructure the attribute-perception model (by comparing DIT with social network theory) proposing that interpersonal interaction as well as individual decision making, is important within the DIT framework. Within the context of community studies of diffusion of energy conservation behaviour (e.g. the Twin Rivers study, Seligman, Darley and Becker, 1978), they conclude that the flow of information via interpersonal networks is more influential in adoption than mass media channels of communication, thus emphasising the importance of the social context and interpersonal networks in the diffusion model.

Guagnano et al. (1986) argue that innovation perceptions are a crucial aspect of the diffusion process. They included risk (see definition above section 2.3) in their study of 406 solar adopters and 300 non-adopters across three regions of the USA. They used a survey to investigate attitudes towards and perceptions of solar technology and towards

energy independence, conservation and environmental protection. Like Klein (1983), they suggest that men will be the decision makers when it comes to choosing solar technology and in contrast to the above studies, male and female responses were assessed using post-hoc comparisons. Overall, findings suggested that adopters were better educated, had higher incomes and were significantly younger than non adopters. Also, adopters and procrastinators viewed solar heating as less complex, more convenient to use and more economically advantageous to own, thus replicating the findings in Lebay and Kinnear's (1985) empirical work. Similarly to Sawyer and Wirtshafter (1985) and Klein (1983), adopters valued energy independence and conservation.

Using 43 likert-scale responses for innovation perceptions, as well as nine questions on energy independence and conservation, Guganano et al. (1986) used a factor analysis to explore the dimensional structure of the six adoption characteristics. This confirmed the hypothesised structure of the attribute perception model. However, sub factors were revealed within the characteristics (e.g. risk comprised two sub-factors: perception of post purchase and pre purchase risk) which suggests that there are in fact more than six factors. Furthermore, they found that complexity also comprised two factors: complexity of use and complexity of installation. Observability items loaded only on one factor, as did trialability items. The nine additional questions regarding energy independence and conservation formed three distinct factors: energy independence from government and utilities; conservation behaviour; and conservation ideals. Relative advantage fell into three highly correlated factors: relative economic advantage; relative convenience; and relative prestige, which confirms the findings of previous innovation research for relative advantage (Rogers, 2003). Therefore, this study suggests that more than six factors may be implicated in attitudes to solar technology.

Like Darley and Beniger (1981), this study concludes that there may be independent factors that influence perception of innovations that should not be grouped with the six dimensions but that may reveal further information about adoption decisions. This is

something to bear in mind when applying the model to participants' accounts of their perceptions of solar technology in a new research setting.

It is surprising that these quantitative studies, which replicate Rogers and Shoemakers' (1971) findings that adoption is associated with higher income; higher education level and younger age, do not relate these variables to Rogers' description of heterophily or homophily. In his discussion of the theory, Rogers (1983) points out that knowledge and experience of an innovation are highly related to social status and education and other such socio-demographic factors which would suggest that socio-demographic differences between adopters and non adopters are a likely finding (except when adoption is non-voluntary, as is the case in this research project).

Wisenbilt (1981) reviewed the conceptualisations of the innovation-attribute perceptions and empirical work carried out in the 1970s investigating factors affecting adoption of solar technology. From this, he suggests that factors arising in the literature and from empirical studies (such as Labay and Kinnear, 1981) that affect homeowners' perceptions and attitudes are a) economic feasibility, b) reliability, maintenance, and safety, c) legal and regulatory issues relating to installation of solar technology and d) regional aspects. Wisenbilt (1981) concludes that looking at the financial aspects of adopting solar technology can be unreliable and that the unstable character of these factors may affect perceptions of financial risk and economic relative advantage, which may therefore compromise reliability of the studies. Also, regional differences such as climate need to be taken into account. He therefore highlights this as a limitation of Lebay and Kinnear's (1981) study. He concludes that adopters' perceptions of the six attributes should be studied further. Also, if the factors are related to the six attributes then perhaps it would be fair to assume that people's attribute perceptions will change over time, thus further supporting Lebay and Kinnear's (1981) suggestion that longitudinal study of adopters' perceptions is required.

After discussing Wisenbilt's (1981) conclusions in his review, we now consider how hypotheses regarding Braunstone can be derived in relation to the six theorised perceived attributes of an innovation.

As set out above, in classifying the above four factors (economic feasibility; reliability, maintenance, and safety; legal and regulatory issues relating to installation of solar technology; regional aspects) according to the six attributes, Wisenbilt (Ibid.) concludes that results of studies looking at barriers to solar adoption in purchase decisions based on economic feasibility are unreliable because calculating financial relative advantage is very difficult. This is because calculating energy savings to be made from installing energy systems and payback period is affected by system efficiency, location of the system, utility rates and tax breaks. Furthermore, he suggests that it is difficult to predict the future price of fossil fuels or solar incentives by state or federal government and that householders may relocate regularly. This issue may be relevant to PV tenants in social housing who are on one-year tenancies.

As mentioned in section 2.2.1, tenants of PV homes in this study differ from 'typical adopters' in the above studies on many characteristics, but most obviously in that they are not consumers but housing association tenants. They are therefore not voluntary adopters of solar technology in that they have not gone through each of the adoption-decision stages as theorised by Rogers (2003). Instead, the decision to adopt has been made for them by LHA and, as such, would be described by Rogers as an 'authority decision'. However, although the tenants in Braunstone will not be interested in financial relative advantage in terms of purchase of a system and payback period, as they are on low incomes, they may be keen to ascertain financial relative advantage over their current system in terms of electricity cost savings. It is interesting to consider what effect just having moved into a new refurbished property has on perceived economic benefit of PV. Following Wisenbilt (1981), it may be that: a) economic; b) social; c) physical; and d) functional relative advantage will be relevant to tenants in Braunstone.

Wisnibilt's (1981) conceptualisations of payback period and calculating energy savings relate to relative advantage and complexity. Kempton and Montgomery (1982) suggest that people make systematic errors in calculating their energy consumption choosing to estimate it in monetary terms rather than energy units. This is made difficult by utility bills that aggregate residential energy usage. This raises the issue of how savings are represented on tenants' utility bills. Complexity in understanding energy bills or the solar equipment relating to energy savings may be factors affecting people's attitudes towards and perceptions of solar PV. Finance and feelings of ownership may be interrelated with these issues given that PV tenants are on low incomes and that tenancies with LHA are for one year. Do people think of solar PV as a long-term feature in their neighbourhood and house? Does this affect perceptions of PV?

In defining perceived risk, Wisnibilt (1981 p92) adds physical and functional risk to social and economic and defines perceived risk as, "the degree to which economic, social, physical, and functional risks are perceived as associated with the innovation."

At the time of Wisnibilt's (1981) review there were no regulations regarding warranties and performance of systems. This is encompassed within the physical risk and trialability attribute-perception dimensions. There was also evidence that some people were keen to show their system to those wanting information. Wisnibilt (Ibid.) suggests more research needs to examine consumers' perceptions of risk and the role of demonstration programmes in allaying any concerns. Following this, how does the example of a solar panel trialability scenario, where the tenant gets to try for free within a social housing context, affect tenants' attitudes towards and perceptions of solar PV? The only way out of the trial is if tenants leave the tenancy. What impact, if at all, will this have on how tenants view the panels?

In Braunstone, issues of safety and functioning could relate to perceived risks. Tenants may wonder whether the panels are working, or what to do if the panel breaks, or whether they have to pay maintenance costs. Also there is anecdotal evidence to suggest that planners and tenants in some communities have raised concerns about vandalism of

PV panels (Warwick, 2001). Braunstone is regarded as a high crime area, so this is a possible concern here.

In a recent study Roy et al. (2007), using interviews with 14 environmentally interested university staff, categorised influences on adoption of low or zero carbon products according to Murphy and Cohen's (2001) properties of objects. The aim was to identify factors affecting individual consumers' decisions to adopt and use ecological products. Influences were categorised for different user groups dependent on where they lay along the innovation decision process. For example, interviews were carried out with adopters, potential non-adopters and non-adopters, but adopters were further categorised into 'engaged adopters', that is, adopters who continue to use their product after purchase and 'non-engaged adopters', people who use more energy following their purchase decision due to the perceived energy saving benefit of the product. A further category of adopters was 'reject users'. These were people that stopped using their low or zero carbon technologies after purchase. 'Hotspot' influences affecting perception of the product were identified for the different adopter categories. These included: utility (e.g. ease of use, cost and reliability); symbolism (i.e. wanting to demonstrate 'greenness'); better feedback on energy consumption; interconnectedness of services and repairs; consumer variables (such as understanding of how to use the product in the most energy efficient manner, attitudes and values of adopters and socio-economic context). They concluded that to increase adoption, it is necessary to consider the different adopter categories and ensure that each system is designed from a people-centred perspective (i.e. one that takes into account the social, economic and technical influences on the innovation decision process). This suggests that it is important to consider different adopter characteristics and the social context in order to understand the particular influences affecting diffusion of solar PV within a neighbourhood such as Braunstone.

2.8 Summary of empirical work

The review has shown that there has been relatively little academic research on social issues relating to solar technology in the UK. Research on people's attitudes to solar technology was primarily carried out in the aftermath of the 1970s oil crises and tended to focus on technical and financial aspects of installing solar technology and understanding the adoption process. Most of these studies were conducted in the USA making the Braunstone study relatively novel.

Sawyer and Wirtshafter (1985) and Klein (1983) assessed first time users' experiences of solar hot water and solar heating systems on factors such as thermal contribution of systems, anticipated payback period, reliability of systems and repair costs. Overall, respondents were more enthusiastic than their experience seemingly warranted. Klein, in addition to technical and financial aspects, looked at the impact of solar systems on behaviour and found that 40% of households with solar water systems changed their daily and weekly bathing and laundry habits. In addition, estimates of hot water contribution were found to be lower when the solar system was shared with another household, despite output being sufficient, indicating a discrepancy between perceived energy output and actual output. This suggests that social and psychological factors affect perceptions of supply and energy use.

Much of the research on attitudes to solar technology has been carried out within the framework of DIT (Rogers, 2003), which proposes that there are five attributes that underpin attitudes towards and perceptions of an innovation: relative advantage; compatability; complexity; trialability; and observability. Lebay and Kinnear (1981) and Guagnano et al. (1986) used questionnaires to investigate characteristics of adopters and non adopters and the factors that affect their decision to purchase solar technology. These five attribute perceptions are commonly discussed in the solar technology and energy conservation research from this period (e.g. Lebay and Kinnear, 1981; Darley and Beniger, 1981; Guganano et al. 1986; Wisenbilt, 1981) with the addition of a sixth attribute of risk. Overall, the results of these study support Rogers' (2003) assumptions

with regard to the attribute perception model, that is, that adopters compared to non adopters rated solar technology as higher in relative advantage, compatability, and observability and lower in complexity. Inconsistent with Rogers (2003) was that adopters perceive solar technology as lower in trialability. Further, perceptions of pre and post purchase risk were found to be lower compared to non-adopters. (Lebay and Kinnear, 1981)

Lebay and Kinnear's (1981) and Guagnano et al.'s (1986) studies involved explicit data analysis techniques, but the other studies reviewed (e.g. Klein, 1983; Sawyer and Wirtshafter, 1985) were not as clear in reporting the data analysis procedures used in their studies. Klein's (1983) and Sawyer and Wirtshafter's studies offer some useful insights nonetheless. Guagnano et al. (1986) also ran a factor analysis and found that some of the six characteristics are comprised of sub factors. This suggests that the list of characteristics of an innovation that are rated by potential adopters are not definitive.

The studies reviewed also emphasise the importance of interpersonal networks such as friends, work colleagues or via special fares (e.g. Darley and Beniger 1981; Hackstock et al. 1995; Klein, 1983) for influencing attitudes to PV and for demonstrating its benefits.

2.9 Conclusion

This chapter has considered a number of studies that have used Rogers (2003) DIT to look at attitudes towards and perceptions of solar technology. The theory aims at an explanation of the trajectory of an innovation such as a RET in terms of whether it is adopted by society or rejected. Rate of adoption is explained in terms of the adoption-decision process and perceptions of the attributes of an innovation, and social processes that lead to the adoption decision (such as social norms and communication sources). For this current study, a theoretical framework was needed that would structure understanding of how a new technology is accepted by individuals within a neighbourhood. In considering its application to Braunstone, the theory examines both

individuals and groups as units of analysis and as such it highlights the importance of both the social environment in which the PV tenants function in Braunstone and their individual perceptions of PV.

Individually, the studies in this review do not provide a complete view of DIT but a focus on different segments of it. The empirical studies focus on the individual level of analysis and were found to fall into two categories: 1) personal characteristics/social diffusion networks which involved qualitative as well as quantitative social research tools (e.g. Klein, 1983; Darley and Beniger, 1981); 2) personal characteristics/perceptions of characteristics of solar technology (involving use of the five characteristics of the attribute perception model and the addition of a sixth characteristic, risk). These studies employed the use of large quantitative surveys (e.g. Lebay and Kinnear, 1981; Guagnano, 1986).

These studies suggested that other factors beyond technical and financial considerations are important when considering how people form attitudes to solar technology (e.g. independence from utility monopolies, energy conservation ideals, status). Importantly, Guagnano et al. (1986) suggest that the list of five attributes is not definitive and that different innovations within different contexts could reveal sub factors, or entirely different factors, on which individuals judge innovations.

In addition, the social studies in this review highlight that diffusion of an innovation depends on communication between members of a social system and that later adopters are dependent on reports from adopters earlier in the decision making process. This illustrates that social networks are important in communicating information and subsequent attitude formation towards a new technology, such as solar PV. In summary, the factors in Table 2.2 were found to be related to attitudes in the above studies and were investigated empirically in the Braunstone study.

Related to understanding the dynamics of an imposed decision and the delivery of the project, this thesis, in contrast to the studies above, is interested in attitudes and

perceptions towards solar PV and a domestic renewable energy project in the pre-installation phase. No research has been found which looks at what people think of having solar PV before it is installed. As the studies above show, it is more common to study attitudes post installation. This research is therefore useful because it helps to highlight concerns that may need to be addressed in order to promote acceptance of household RETs.

Table 2.2 Factors affecting attitudes to solar technology

	Factors	Authors
1	Reliability and safety of equipment	Lebay and Kinnear (1981); Guagnano et al. (1986); Wisenbilt (1981)
2	Prestige/status gained from adoption	Guagnano et al. (1986) Hackstock et al.'s (1995), Klein (1983), Wisenbilt (1981)
3	Political ideology, independence from centralised fuel sources and energy conservation	Guagnano et al. (1986) Hackstock et al.'s (1995), Klein (1983)
4	Information from friends, social networks	Guagnano et al. (1986) Hackstock et al.'s (1995), Klein (1983)
5	Socio-demographic factors	Hackstock et al. (1995); Klein (1983); Guagnano et al. (1986); Lebay and Kinnear (1981)
6	Gender roles	Klein (1983), Guagnano et al. (1986)
7	Occupation	Klein (1983)
8	Changed behaviour patterns resulting from hot water profile from equipment	Klein (1983)
9	The six attribute perceptions	Guagnano et al. (1986) Lebay and Kinnear (1981), Wisenbilt (1981), Darley and Beniger (1978)

DIT places emphasis on the role of personal and socio-economic characteristics such as age in shaping the adoption-decision process. Commonly, studies using the DIT perspective have compared adopters, non adopters and potential adopters of solar technology or other ecological products and systems in order to further understanding of the personal characteristics of adopters. With the exception of Hackstock et al. (1995), users of solar technology in all of the mentioned studies were relatively high income earners who had an interest in global environmental issues and decentralisation of the energy supply. This study will extend understanding of an authority-adoption decision

and attitudes to solar energy by looking at an entirely different socio-economic group. The research takes place in a 'disadvantaged' area with people who are on very low incomes and who may not have particularly strong environmental or self-sufficiency values. The tenants are similar to Hackstock et al.'s (1995) sample in that they can be described as 'atypical adopters'. However, Braunstone tenants differ in that they are not pioneering solar energy enthusiasts with technical occupations.

DIT suggests that social factors evolving out of the social context in which the decision takes place, influence decisions and consequently the trajectory of the innovation. In light of what the reviewed studies reveal about interpersonal networks and system norms, this thesis is interested in social and cultural influences in Braunstone and the community level of analysis. Subsumed within the community level of analysis is the household level of analysis as it is assumed that individuals in households will be influenced by social networks inside, as well as outside, the home.

Rogers and Shoemaker (1971) are cited in solar research studies as finding empirical evidence in their work for an attribute perception model consisting of five factors that are suggested to influence an adopters' attitude and perception of an innovation. These five attribute perceptions are commonly discussed in the solar technology and energy conservation research from this period with the addition of a sixth factor of risk, which is attributed to Bauer (1960). However, the six factors, have been shown to comprise further sub-factors (Guaganano et al., 1986) and the review shows that they have not been applied in understanding attitudes to PV in low-income groups. However, the factors have repeatedly been used to categorise how people think about solar technology and further to this, studies showed that they were found to be better predictors of attitudes to solar thermal technology than demographic variables. The attribute perception model was used in quantitative studies to assess adopters' perceptions of solar technology. It is likely that a more open-ended approach would reveal other factors implicated in people's assessments of solar technology. The attribute perception model is not expected to capture all of the factors involved in perceptions of solar PV. In contrast to the studies reviewed, the model is not used in the present research to assess

its ability to predict rate of adoption. However, this study investigates whether the model is useful for categorising and understanding people's responses to PV panels. This thesis also aims to extend this model in providing an analysis of factors affecting perceptions of PV among social housing tenants. With this in mind, the next chapter presents research that has not used DIT as a basis for understanding adoption of sustainable energy technologies, but that may provide further useful insights.

3 Contemporary Social RET Research

3.1 Introduction

The previous chapter described aspects of DIT and identified studies that applied the theory to understanding adoption of solar technology. This chapter introduces contemporary research investigating adoption and diffusion of sustainable technologies that have not used Rogers' (2003) theory as a basis. These have been included due to their potential for shedding light on attitudes towards and perceptions of solar technology in the case-study site.

3.2 Non-diffusion studies of solar technologies

The Peabody Trust, London's largest social landlord and pioneers of solar PV in social housing conducted a survey looking at perceptions of PV amongst social housing tenants in Kings Cross, London. This information came from PowerPoint presentation slides made available on the internet (Warwick, 2001). Unfortunately, details of the methodology for this research were not available. However, on telephone contact with the Peabody Trust, it would appear that the survey was an open response format. It was found that concerns about PV were related to lack of information (e.g. tenants thought that PV might disrupt their TV signal, or be noisy). Negative concerns were also financial, such as PV was seen as expensive and a use of resources that could be better spent elsewhere. This perception among social housing tenants that resources would be better spent elsewhere is interesting, suggesting perhaps that housing conditions and other social issues may be seen as more important by this sample.

As set out in section 2.6, Wisenbilt (1981) reviewed studies carried out in the 1970s and classified factors affecting attitudes towards and perceptions of solar technology arising from these studies according to Rogers' (2003) six attribute perceptions. This method will now be used in interpreting and classifying the factors that tenants raised as barriers

to the acceptance of PV in the above Peabody study (where applicable). Table 3.1 shows the Peabody tenants’ concerns classified according to the six perceived attributes.

Table 3.1 Tenant concerns relating to the six perceived innovation attributes

Factor	Attribute Perception
Disruption of TV signal	Physical Risk/Complexity
PVs will be noisy	Physical Risk
Fear of lightning	Physical Risk
Electromagnetic fields	Physical Risk
PVs could be a fire risk	Physical Risk
Vandalism/theft	Physical Risk
Glass could break and fall on people	Physical Risk
PVs could overheat (connected to global warming and climate change)	Physical Risk
Too innovative (unfamiliar)	Complexity
How will they know they are working	Complexity
Tenants being used as guinea pigs	Self-efficacy*
Expensive use of resources that could be used better elsewhere	Relative (dis)advantage
Suspicion of low energy prices*	Risk
Who’s going to benefit?*	Risk

* Self-efficacy is a principle from Identity Process Theory (Breakwell, 1986).

* Suspicion of low energy prices and who is going to benefit could also be related to mistrust in institutions.

In Table 3.1, the attribute ‘perceived risk’ is used to classify tenants’ concerns relating to how the PV functions. Perceived complexity is used to classify tenants’ concerns related to unfamiliarity of PV cells. Relative advantage has been used to classify concerns relating to whether PV is a good idea or not given the perceived need to spend resources elsewhere. Psychological concepts of efficacy (Breakwell, 1986) do not relate conceptually to DIT, but classify feelings of “being used as guinea pigs”. This concept of efficacy is discussed further in Chapter 4 of this thesis. This classification exercise illustrates that social housing tenants’ concerns about and perceptions of PV can usefully be examined using the attribute-perception model, but that other psychological factors may arise that do not link to the model. These findings are revealing, as this is the only

UK study investigating the attitudes of social housing tenants in relation to a PV project of this scale.

In an MSc project, Knapp (2004) used an internet survey of 262 UK participants to investigate motivations to install domestic renewable energy technologies in their homes. A qualitative approach was used in this study, which allowed more in-depth information to be gathered on participant motives. In a similar way to the classification of perceptions in the Peabody study, the motives are interpreted, tabulated and linked to psychological theory and/or constructs explored in this literature review.

Whilst some of the motives to install sustainable energy technologies can be linked to the DIT framework, Table 3.2 shows that DIT does not account for people’s motivations entirely, but that other factors such as ‘environmental concern’ and ‘distinctiveness’ (Breakwell, 1986) may be implicated in motivations to purchase renewable energy. Further discussion of distinctiveness is provided in the next chapter.

Table 3.2 Motives to install RET classified by related theoretical issues

	Factors	Theory or Concept	Theory
1	Environmental Concern	Environmental concern	Stern and Dietz (1994)
2	To reduce pollution	Environmental concern	Stern and Dietz (1994)
3	Reduce fuel bills	Relative advantage	Rogers (2003)
4	Free energy	Relative advantage	Rogers (2003)
5	Grants	Relative advantage	Rogers (2003)
6	Combating the greenhouse effect	Environmental concern	Stern and Dietz (1994)
7	Climate change	Environmental concern	Stern and Dietz (1994)
8	Recommended by friends	Social networks	Rogers (2003)
9	Work in local government	Social networks	Rogers (2003)
10	Simplicity of system	Complexity	Rogers (2003)
11	Wanted to demonstrate benefits of renewable energy technology to society	Observability	Rogers (2003)
12	To reduce carbon emissions	Environmental concern	Stern and Dietz (1994)
13	Greenhouse gas emissions	Environmental concern	Stern and Dietz (1994)
14	To upgrade heating system	Relative advantage	Rogers (2003)

15	Long term investment	Relative advantage	Rogers (2003)
16	Purchased house built with renewable energy system	Relative advantage	Rogers (2003)
17	Newspaper advertisements/article	Media (communication)	Rogers (2003)
18	Investment in alternative ideas	Risk/compatibility	Rogers (2003)
19	Wanted to demonstrate solar hot water to friends and family	Social networks/relative advantage (status)/observability	Rogers (2003)
20	Doing my bit for society	Altruistic Values	
21	Ease of product availability	Relative advantage	Rogers (2003)
22	Worried fuel cost would rise in the future	Economic relative advantage	Rogers (2003)
23	Wanted modern energy system	Relative advantage	Rogers (2003)
24	Had old solar system before	Compatibility/relative advantage	Rogers (2003)
25	Used Solar system on holiday abroad	Familiarity/compatibility	Rogers (2003)
26	None of my neighbours has got it	Status (relative advantage)/distinctiveness	Rogers (2003)/ (Breakwell, 1986)
27	Believe renewable energy technologies are a viable energy source	Compatibility	Rogers (2003)
28	No mains electricity	Relative advantage/compatibility	Rogers (2003)
29	Live in a windy place	Compatibility	Rogers (2003)
30	Close to cycles of nature	Compatibility	Rogers (2003)
31	Wanted to be self sufficient	Compatibility	Rogers (2003)

In contrast to the attribute-perception model studies, the above two studies used qualitative data. This appears to be a useful approach in illuminating conceptual issues outside the scope of DIT.

3.3 Summary

Some recent UK research has looked at perceptions of PV amongst social housing tenants (Warwick, 2001) and at incentives to adopt household RETs (Knapp, 2004). These studies investigated attitudes and perceptions of solar thermal technology without reference to any explicit theoretical framework. However, these studies suggest that there are other factors that affect attitudes to RETs that are not necessarily encapsulated in a DIT framework (e.g. distinctiveness). To understand what factors influence contemporary attitudes to solar technology more empirical research on social aspects of solar technology is needed with a coherent theoretical framework and rigorous analysis.

The present study differs from most diffusion research in that tenants in Braunstone are not pioneering homeowners, but social housing tenants who are recipients of a large PV project.

3.4 Conclusion

The studies presented in this chapter were not conducted within a DIT framework. Collectively they suggest that other factors not explained by diffusion of innovations theory, may be important to consider if investigating attitudes to PV in a UK social housing context. For example, trust in organisations, knowledge of systems and feelings surrounding efficacy (feelings of control in managing one's self) were found to be implicated.

Chapter 2 and 3 suggest that the list of innovation characteristics may be useful in categorising the factors affecting attitudes to PV in Braunstone, but at the same time, the solar studies and DIT do not capture all of the important characteristics of the Braunstone context. Therefore, it was decided to amalgamate DIT with other theories that might underlie social and psychological processes affecting support for PV in Braunstone. Burningham and Thrush (2001), Twigger Ross and Uzzell (1996) and Bonaiuto, Carrus, Martorella and Bonnes (2002) suggest that it is important to consider

the physical local environment in understanding environmental attitudes and concern. DIT suggests that the 'social system' might influence attitudes to an innovation, but other research has suggested that the physical environment may influence attitudes to RETs as well. It was therefore decided that the research would take a "place-specific perspective" (Bonaiuto, et al., 2002 p631), focusing on the relationships people have with the physical environment. The next chapter will review literature on place concepts and illustrate how they may relate to attitudes to PV.

4 Place Theory

Psychological theories of 'place' allow for an exploration of how people are psychologically connected to and influenced by particular settings. This chapter presents the framework for the investigation of the role of place in shaping responses to PV.

Using studies from social and environmental psychology, this review sets out to add a social-psychological perspective to the review of literature in the previous chapter on DIT. Studies reviewed in this section illustrate how studying social-psychological processes as components of theorised relationships with place in Braunstone may provide useful insights to tenants' attitudes towards PV. The review highlights some of the key elements of contemporary understandings of place and points to their potential for understanding attitudes to PV in Braunstone. In particular, it summarises some of the key insights from the study of environmental attitudes and behaviours from a "place specific' perspective" (Bonaiuto, et al., 2002 p631).

There is extensive academic literature on people's relationships with place. There has been widespread research investigating how place is implicated in people's experience, not just in environmental psychology but across disciplines such as anthropology, sociology and geography. As place is conceptualised so broadly, it was necessary to focus the review for the purpose of setting forth plausible hypotheses relevant to the research context. Although it may be that many of the theorised components of people-place relationships could be relevant to PV tenants' psychological experience of place in the research context, of particular interest are aspects of PV tenants' relationships with places both in Braunstone or elsewhere that affect perceptions of PV. There is also interest in whether the PV affects tenants' 'sense of place'. More specifically, the review asked what does research tell us about how relationships with place may influence attitudes towards PV and equally about how PV may influence relationships with place.

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environmental perceptions, attitudes, behaviour and environmental concern (Farnum et al., 2005) and more recently it has been suggested that such understanding can help to explain phenomena such as citizen involvement in decision making regarding land or public spaces, and natural resource management (Bott et al., 2003; Farnum et al., 2005).

As well as the study of environmental attitudes and behaviour within environmental psychology and its importance for practical fields (such as natural resource management), the psychology of place is relevant to the current Labour government's 'third way' philosophy of social inclusion and policies concerning the fostering of sustainable communities. This is reflected in the vision for cohesive communities as set out in the Department for Communities and Local Government report "*Place Matters*" (2007). O'Sullivan (2002) argues that understanding the psychological and socio-cultural dynamics of places can shed light on issues of social exclusion. The notion of social exclusion implies participation and citizen involvement in environmental issues which De Young (1999) highlights is a growing area of study in environmental psychology.

Concepts of place and social exclusion are integrated in this study given that the context of the project is a 'New Deal for Communities' area, just having undergone physical and social transformation from a run-down council estate. Related to the idea of a community in transition, is the notion that changes in the environment can affect identity processes by acting as threats to the principles suggested by Breakwell (1986) to govern identity. Furthermore, place transformation has also been suggested to make place attachment more salient (Twigger-Ross and Uzzell, 1996). Both of these points are addressed later in this review and highlight that the psychology of place provides a useful framework for understanding both contemporary social issues and the study context investigated in this thesis.

4.2 Different perspectives on place

Methodological approaches to the study of place can be broadly divided into phenomenological and positivist. The phenomenological approach is based on subjectivism of psychological phenomena and is therefore concomitant with the qualitative approach to research. The positivist approach is aligned with behaviourism, which has traditionally dominated UK and USA psychology. The characteristics of these approaches are further set out in Chapter 4 of this thesis.

Manzo's (2003) comprehensive review of literature, exploring people's emotional relationships with places, suggests that the phenomenological literature is an important starting point for understanding the nature of these relationships. The phenomenological approach emphasises descriptive accounts of people's experiences and meanings and Manzo (2003) suggests that this approach has the advantage of exploring a range of settings that are focal to human experience. Phenomenological studies gave accounts of meaning and experience of place without looking for causal explanations which are consistent with reductionist theories in traditional Anglo-American psychology.

This phenomenological perspective is closely aligned with geographical research, which described place in experiential terms. For example, Relph (1976) described human place experience in the world as a dialectic between existential insideness and outsideness. Existential insideness involves sub-conscious reflection because a place is so familiar, but existential outsideness leads to feelings of alienation from a familiar place. Through various degrees of insideness and outsideness of different places, people can assume different identities. Relph's (1976) dialectical notion of insideness and outsideness draws attention to the unconscious nature of experience of place. This notion of place is useful for two reasons; firstly, the suggestion that place attachment is unconscious has had implications for its empirical investigation, particularly with regard to dislocation or place transformation (e.g. Twigger-Ross and Uzzell, 1996 suggest that considerable change in an area makes relationships with that place a more salient issue). Secondly, Relph's (1976) conceptualisation of place implies that experience of places may not be

entirely positive. Manzo (2003) argues that this is important because research on place has typically considered positive emotional attachment with places, partly “because of the tremendous significance of ‘home’ as a metaphor for experiences of joy, protection, comfort, and belonging to places” (Manzo, 2003 p49).

In contrast to a phenomenology and human geography, study of objective features of place based on space and object perception of individuals was dominant in environmental psychology until the late 1970s. This sort of experimental research was influenced by more reductionist behaviourism (Bott et al., 2003).

Bonnes and Secchiaroli (1995) note the development of a transactionalist approach, which takes into account the conflicting epistemological perspectives of phenomenology and behaviourism. The transactionalist approach stresses the person as a dynamic unit that interacts with the environment, where both the environment and the person act interdependently on each other (as opposed to the phenomenological approach which is concerned with just ‘being in’ the world). Similarly, Manzo (2003) suggests that relationships with place are dynamic and change over time and that both person and place can change and that this is an ongoing process.

The transactionalist perspective emphasises cognitions and social context in people’s relationships with the physical environment. The beginning of the transactionalist perspective therefore represented a shift in environmental psychology during the 1970s, which is widely attributed to Canter’s (1977) definition of place as an amalgamation of three characteristics: a person’s perceptions; a setting’s physical characteristics; and the behaviours that occur in that particular setting. Stedman (2002) describes how a three component view has dominated the literature on place by arguing that:

places include the physical setting, human activities and human social and psychological processes rooted in the setting (Stedman, 2002 p562).

4.3 Theories of place

Since Canter's (1977) first succinct model of place, concepts used to define place relationships have undergone considerable changes and re-evaluations. Furthermore, understandings of the person-environment interaction have emerged across a number of different disciplines (e.g. the concept of place was stimulated by humanist geographers in the late 1960s) and different epistemological foundations (Patterson and Williams, 2005). Therefore, within the environmental psychology literature, theorising on place has been criticised for generating confusion, for being overly complicated and for lacking consensus in definition of its core concepts. For example, Manzo (2003) notes that definitions of place have been the subject of much debate and additionally, the lack of operationalisation of concepts or testing of place theories, has been criticised by Twigger-Ross and Uzzell (1996). Similarly, Stedman (2002 p561), when discussing 'sense of place', notes that, "there have been few attempts to build systematic theory, and there remains lack of agreement on the meanings of core concepts". In recognition of this, Farnum et al. (2005 p3) point out that "authors generally intend that the term [sense of place] be used broadly, and they acknowledge the difficulty in encapsulating it in simple terms."

As Knez (2005), Manzo (2003; 2005) and Patterson and Williams (2005) point out, concepts such as 'sense of place', 'place attachment' and 'place identity' have dominated the literature on psychology of place-people relationships and there is disagreement amongst authors as to the definitions of these concepts and the relationships between them. For example, Manzo (2003; 2005) and Farnum et al., (2005) point out that it is argued by some authors that sense of place, place dependence and place identity are all forms of place attachment. Other authors suggest that place attachment and 'sense of place' are two separate concepts used to describe the same type of bond with place (Farnum et al., 2005). Consequently, sense of place and place attachment are analogous terms in different disciplines. (Farnum et al., 2005). Other authors suggest that place attachment forms a part of place identity (e.g. Proshansky, Fabian and Kaminoff, 1983). A further point of debate is whether psychological

concepts that make up theoretical frameworks of place-people bonds are affective, cognitive or behavioural (e.g. Stedman, 2002). This is summarised by Bott et al. (2003) who suggest that relationships with place have motivational elements, such as emotions and values, and that theories of place vary according to how much weight they give such elements.

In respect to the meanings of 'affective' and 'cognitive', the American Psychological Association (APA) defines 'affective' as "pertaining to emotion or feelings" (APA, 2007 p26). 'Cognitive' is defined as "all forms of knowing and awareness, such as perceiving, conceiving, remembering, reasoning, judging, imagining and problem solving" (Ibid. 2007 p187).

Manzo (2003) and Stedman (2002) consider how the loose definition of 'sense of place' is further complicated by different methodological approaches to the study of place. All of these criticisms are summed up concisely by Patterson and Williams (2005 p362):

the variety of disciplines from which place research is now approached has helped to create a situation in which there is little agreement regarding the name of the underlying concept, its definition, or what methodological approach is best suited to its study.

Patterson and Williams (2005) are less critical of the seemingly contradictory nature of place concepts. They suggest that the *mélange* of different concepts, and their corresponding underlying methodological approaches, are acceptable given that relationships with place are complex. Furthermore, they argue that epistemological variation is necessary for understanding the eclectic approach to place research and for pushing scientific knowledge on place research forwards.

Perhaps this diversity in perspectives and approaches to researching place can be compared to other research traditions within environmental or social psychology such as the attitude-behaviour paradigm. Although it is the case that all social research traditions go through revisions and evaluations as suggested by Altman and Low's (1992) three

stages of evolution of concepts within social science research (as cited in, Patterson and Williams, 2005), the concepts and theoretical framework in which they sit, compared to place theories, seem to be less contested. As Patterson and Williams point out, it is understandable that there are so many attempts at conceptualising place and so many different research programs because place is so complex and as Bott et al. (2003) assert, relationship to place is a fundamental feature of human existence. This relationship, in broadest terms, is as various and extensive as are the human interactions with their surroundings'. This echoes thinking in the phenomenological approach.

In summary, reaching consensus on definitions of relationships with places can be problematic because of the following issues:

- Depth of our psychological relationships with place as hinted at by the phenomenologists and Bott et al. (2003). Place relationships can be as extensive as humans' experience of their environment. Related to this, the meaning of relationships with place can vary across individuals and across specific contexts (Bott et al., 2003).
- The wide variety of factors that underpin people's relationships with place. For example, it has been suggested by Bott et al., (2003) that there are a diverse range of influences relevant to our own relationships with place. Some processes and characteristics of place are internal (e.g. attitudes, beliefs) and some are external (e.g. social or historical processes).
- Some of these social, external factors affect relationships with place directly. Others act indirectly by shaping and constraining the social context within which relationships with place are negotiated. For example, Manzo (2003) suggests that place needs to be thought of in a political context, i.e. how the social structure influences our relationships with places.
- Relationships can be conscious or unconscious Relph (1976), (Manzo 2003).
- There is a lack of consensus over empirical conclusions and models (Manzo, 2003; Stedman, 2002; Patterson and Williams, 2005).

- Manzo (2003) also suggests that historically, there has been an emphasis on empirical research on place focusing on the home and positive affect, which has constrained academic understanding of place.
- Research has drawn from a wide range of social science disciplines. Manzo's (2003) review shows there are diverse meanings of the concepts of place in different research traditions.

Bearing these points in mind, and also acknowledging that there is debate about how theoretical maturation is best achieved, how best to achieve conceptual clarity and whether study of these constructs can be 'summed up into a neat propositional inventory of empirical findings' (Patterson and Williams, 2005 p362), the following section will examine place theories commonly applied in environmental psychology. These are: sense of place; place attachment; place identity, place satisfaction; and PRSI.

4.3.1 Sense of place

Farnum et al. (2005) assert that sense of place refers to the cognitive and affective components of a person's relationship with a certain place and, as such, is a general term encompassing both affective and cognitive aspects of place:

Sense of place is the most encompassing term, referring to the entire group of cognitions and affective sentiments held regarding a particular geographic locale and the meanings one attributes to such areas. (Farnum et al., 2005 p2).

A social psychological model of sense of place has been proposed by Jorgensen and Stedman (2001) that includes empirically specifiable variables that are drawn from social psychology in order to explore the relationships between the constructs. They suggest that "in general, SOP is the meaning attached to a spatial setting by a person or group." They go on to say that sense of place "SOP is not imbued in the physical setting itself, but resides in human interpretations of the setting" (Jorgensen and Stedman, 2001 p233). Their model proposes that: "sense of place can be conceived as a collection of

symbolic meanings, attachment and satisfaction with a spatial setting held by an individual or group” (Stedman, 2002 p563).

The three concepts in the model of symbolic meanings, attachment and satisfaction are similar to social-psychological concepts of cognitions and beliefs, identity and attitude respectively. These are tried and tested concepts in social psychology and accepted measures exist for each of them. Stedman (2002) suggests that consideration of place concepts within a social-psychological framework is useful and a way of developing place theory because social psychological concepts are clear and open to empirical operationalisation.

4.3.2 Place attachment

Feelings towards a place have been encapsulated by the term place attachment. At its most simple level, place attachment has been proposed as an explanation of people-environment interaction separate from sense of place and the term describes people’s affective (emotional) bonds with places (Altman and Low 1992; Ryan 2005; Hidalgo and Hernandez 2001, Knez 2005). Evidence for place attachment was found in early studies suggesting that people experienced detrimental psychological effects even when forced to leave a slum area (Fried, 1963). Similarly, Burningham and Thrush (2001), in a study of disadvantaged groups, found that people did not want to move from their area despite poor environmental conditions.

There is disagreement as to the components of place attachment and authors such as Stedman (2002) and Hidalgo and Hernandez (2001) have argued that it is an ambiguous concept and its components are related to other concepts. For example, Stedman (2002) suggests that place attachment is the bond between people and their environment and is based on cognition as well as affect. He also suggests that it is based on symbolic meanings which he characterises as beliefs and cognitions about a place. Place attachment, he says, resembles identity. Altman and Low (1992) and Proshansky et al., (1983) similarly suggest that it has cognitive components.

Ryan (2005) suggests that place attachment may be part of an overall attachment that may involve other types of attachment, such as to caregivers or physical objects. Most studies looking at attachment to physical places have looked at attachment to urban areas. Recently however, attachment to other settings, such as natural environments and wilderness, has been explored. Different factors have been found to influence place attachment such as knowledge, length of residence and satisfaction with an area. Furthermore, place attachment varies across different groups of users of places. For example, Ryan (2005) studied place attachment and the relationship between environmental attitudes and environmental attributes in three urban parks in Ann Arbor, Michigan. Three hundred and twenty-eight park users were surveyed using both a written and a picture survey. The survey found that park neighbours and local users demonstrated 'place-specific attachment', whereas park volunteers and expert users demonstrated a 'concept attachment' associated with their environmental knowledge/experience of parks.

Ryan (2005) suggests differences in place attachment types amongst experts, neighbours and users can lead to conflict in the management of parks. There is also debate as to whether a person can be attached to a specific place or a more general place.

Following Stedman (2002; 2003) who suggests that place attachment and place satisfaction can converge, in the present study, tenants may differ in their satisfaction with the area, which in turn might affect their place attachment. Following the research of Ryan (2005), it may be that differences exist in feelings of attachment, according to how well people know the area.

With the increased focus on environmental issues, place attachment has recently become a topic for more detailed exploration with regard to development of renewable energy systems in rural areas. Vorkinn and Reise (2001 p252) suggest that "the focus of much research so far has been on understanding the nature of place attachment and not so much the implications for attitudes and behaviours." They investigated attitudes amongst

tenants towards a proposed major hydroelectric project in a rural area of Norway. They measured place attachment to the entire area of Skjak, Norway, and to five areas expected to be affected by the proposal. Using multiple linear regression analyses they found that emotional attachment to the specific natural areas affected by the proposal was a stronger predictor of attitudes towards the proposal than socio-demographic variables, explaining 17% of the variance.

4.3.3 Place satisfaction

Some place theorists argue that knowing how a place is perceived in terms of satisfaction is necessary in understanding people's relationships with places. Stedman (2002; 2003) proposes attitude-like dimensions of place cognitions and asserts that satisfaction is a general judgment of the quality of settings based on social and physical qualities and activities. It can therefore be argued that place satisfaction is a multi-dimensional evaluative judgement.

Stedman (2002; 2003) suggests that place satisfaction and place attachment can converge. In his study, individuals with strong, positive place attachment, but low satisfaction, were more likely to say that they would act to protect a place. Uzzell et al. (2002) similarly suggested that resident satisfaction is an influence on motivation to act to improve environmental conditions and link this to sustainability behaviours. This follows Pol's (1998) suggestion that poor quality environments serve to increase social cohesion amongst residents who may then work to collectively pursue better environmental conditions. High attachment and high satisfaction did not predict intention to act to protect a place (which further suggests that place characteristics can influence social cohesion and environmental behaviours as suggested by Uzzell et al., 2002). Therefore, Stedman (2002; 2003) also suggests that attitudes towards a place have implications for how people behave. Related to this is Bott et al.'s (2003) assertion that "subjective experience of place is important for telling us how individuals and communities come to care about local places and idealisations about place" (Bott et al., 2003 p104).

4.3.4 Place identity

Relationships with place have been theorised with reference to other psychological theories, including those of identity. Stedman (2002), Twigger-Ross and Uzzell (1996), Proshansky et al. (1983) and Uzzell et al. (2002) have all investigated the nature of place with regard to identity theories.

Place identity is a cognitive structure that has been proposed as a facet of identity implicated in how the physical environment helps develop and maintain a person's sense of 'self'. The notion of self can be traced to theorists such as James (1890) and Mead (1934). These early authors suggested that identity is linked to the social world and their work led to the development of research the development of the self concept and is the root of social identity theory (Tajfel, 1978). James (1890) and Mead (1934) suggested that people strive to maintain self-esteem, that is, positive feelings of self-worth. Therefore, self esteem is taken as a primary motivation for action in relation to identity.

Prohansky, Fabian and Kaminoff's (1983) model of place identity pervades the literature on the relationship between a person's identity and the physical environment. Prohansky et al. (1983) argue that neglect of the physical environment, in relation to definition of the self-concept, restricts our understanding of identity. They define place identity as:

a sub-structure of the self-identity of the person consisting of, broadly conceived, cognitions about the physical world in which the individual lives. These cognitions represent memories, ideas, feelings, attitudes, values, preferences, meanings and conceptions of behaviour and experience which relate to the variety and complexity of physical settings (Prohansky et al., 1983 p59).

They developed the concept of self-identity suggesting that traditionally it did not take into account the influence of physical settings or consider the impact of changes such as relocation. Like the theory of social identity theory, Proshansky et al.'s theory (1983) also has its origins in the work of James (1890) and Mead (1934).

4.3.5 Identity process theory

Twigger-Ross and Uzzell (1996) argue that all aspects of identity are related to place in some way, rather than place being a 'sub-structure' of self-identity. Therefore, they challenge Proshansky et al.'s (1983) theory for separating place from social identity. This, they suggest, generates a problem of two forms of identity existing and of how much weight is given to each. They also suggest that it does not explain, beyond self esteem, why place identity is formed and maintained (i.e. the processes guiding identity) and thus, they argue that Proshansky et al.'s (1983) place identity theory does not entirely explain why place is important for identity.

Twigger-Ross and Uzzell argue that Breakwell's (1986) 'identity process' model proposes a better account of the processes that guide action and how they link to the characteristics of identity. Breakwell's (1986) identity process model proposes that motivational and cognitive processes of identity are governed by four characteristics: distinctiveness; continuity; self-esteem; self-efficacy.

- Distinctiveness – the desire to maintain personal distinctiveness or uniqueness in comparison to others.
- Continuity - the desire to preserve continuity of the self concept over time and situation.
- Self esteem - the desire to maintain a positive evaluation of oneself or group.
- Self efficacy – “an individual's belief in their capabilities to meet situational demands”.

More recently, these four processes that guide identity have been related to place as set out by Knez (2005) and Twigger-Ross and Uzzell (1996). Both past and present places have been suggested to affect continuity of self-identity and therefore, there are two conceptualisations of the identity process of continuity. Five processes are therefore listed.

- Place-related distinctiveness: where identification with place is seen in terms of a social distinction, (e.g. “I am a Londoner”, or “I am from Leicester”, “I am from the ‘Six Streets’”).
- Place-referent continuity: place is a referent for the past (e.g. this place reminds me of my childhood).
- Place congruent continuity: describes when a place fits with a person, their present beliefs etc.
- Place-related self-esteem: (e.g. “living in a town makes me feel good”).
- Place related self-efficacy: (e.g. “I have everything I need to go about my everyday activities in my town”).

Place-related distinctiveness refers to distinctive lifestyles and relationships with the environment. Eyles (1968) found that neighbourhood image and perceived neighbourhood boundaries can influence place identification. People will bend their neighbourhood boundary to identify with people in a smarter area. This also suggests that people may want to distinguish themselves from others. Similarly, Uzzell et al. (2002, p35) suggest that “the geographical limits defined by the residents who identify with a specific area are an important element when differentiating themselves from others who do not live there” and that this is an aspect of place identification.

Distinctiveness can work at the group as well as individual level, as shown by Devine-Wright and Lyons (1997) and O’ Sullivan (2002).

Both past and present places affect continuity of self-identity. Place-referent continuity refers to how past places act as a link to our old selves and are an important referent for who we are. Memories of past places are important for psychological well-being and studies have shown that forced relocation can cause distress, as in Rowles’ (1983) study of an Appalachian community and Fried’s (1963) study of a slum neighbourhood in East London. However, moving can also allow for creation of new identities. The principle of place-congruent continuity is suggested to motivate people to seek out places in the

present that represent their values and beliefs and help maintain continuity of self. It is plausible that components of place- referent continuity may be particularly salient amongst a sample of social housing tenants who have just moved into new houses in what, for some, is a new area.

Self-efficacy is a person's perceived ability to meet demands and achieve goals. When linked to the environment, self-efficacy processes can be thought of in such a way that ideally, a persons' environment does not hinder everyday activity. In the case of PV in Braunstone, one might ask whether PV interferes with usual everyday activity in any way that may be a potential threat to self-efficacy.

Korpela's (1989) study which found that teenagers use their bedrooms to retain a sense of calm in their lives suggests a relationship between place and self-esteem. Twigger-Ross and Uzzell (1996) point out that gaining self-esteem from the environment is different to merely liking it, although the two can be related. PV is a change to the environment and as such is part of a wider set of changes in Braunstone. This raises questions over whether changes impact on resident identity and whether these are in any way linked with the PV project?

Twigger-Ross and Uzzell (1996) examined whether these four principles of identity are manifested in attachment to the East London Docklands area. Notably, the Docklands area was chosen because it underwent redevelopment during the 1980s, leading to an influx of young professionals into a predominately working class area and there was much controversy caused by such social, economic and environmental change.

Following Relph (1976), Twigger-Ross and Uzzell (1996) explain that this is significant because place attachment is usually unconscious. Similarly, Ryan (2005) argues that place attachment may be more salient after negative changes. Regeneration, on the face of it, may seem advantageous to the tenants living in the context of this PhD research study, but paradoxically, it is possible that physical and social changes may be disruptive to people's sense of place and identity processes. Like the Docklands, North Braunstone

is undergoing redevelopment, with plans for a new health centre, parks and play areas and 200 houses have been refurbished by LHA. This change from a run-down area has caused much interest from inside and outside the community, not just in terms of the changes that are being made, but the way they are being administered in a New Deal area. Therefore, the question of whether or not place attachment is largely unconscious (Relph, 1976; Brown and Perkins, 1992) is relevant to the changing research context of this study.

Ten attached and ten non-attached residents between the ages of 26 and 67 years were selected based on extreme scores on an attachment scale. Semi-structured interviews were carried out with 19 residents in their homes, each interview lasting 40 to 60 minutes. The questions probed people's evaluations and experiences of living in the area.

Twigger-Ross and Uzzell (1996) found that place is related to people's sense of self with regard to Breakwell's (1986) four identity characteristics, but that this was more so for residents with higher place attachment. Therefore, aspects of the urban environment were found to be implicated in people's responses that corresponded to Breakwell's (1986) four principles.

There was evidence for place-congruent continuity whereby all ten attached residents compared their environment with places from the past and non-attached residents wanted to find things in their environment that complimented their values. Place-referent continuity was manifested in attached residents not wanting to leave the area. For example, two women wanted to stay because it reminded them of their dead husbands. One man said that he would be devastated if the pie and chip shop were to close down.

A greater number of attached than non-attached residents expressed ways in which physical and symbolic aspects of the local area had a positive impact on them and their self-esteem. Feelings of self-efficacy did not differentiate the two groups, but there was

a difference in the groups in that non-attached residents would more readily leave the area should their manageability (of the environment) become threatened.

Overall this study shows that identity processes have a relationship with the environment and that this may depend on residents' level of place attachment. Twigger-Ross and Uzzell (1996) suggest that all identifications have place implications. Levels of place identification differed for all respondents depending on the time lived in the area which suggests that the person-environment relationship is dynamic (similar to Manzo, 2003).

Given that PV is a physical environmental feature, this study sets out to see whether identity processes are implicated in responses to PV.

4.3.6 Place-related social identity (PRSI)

Similar to Twigger-Ross and Uzzell (1996), Uzzell et al. (2002 p29) suggest that place identity cannot be conceived as a separate component of social identity but that arguably, all aspects of identity have "place-related implications."

Valera and Pol (1994) suggest that place identity is an aspect of social identity, derived from processes of identification, cohesion, and satisfaction. Following this, Uzzell et al. (2002) argue that understanding the role and meaning of physical and social place is essential to the process of developing community environmental initiatives and in understanding environmental values and behaviour. Using a theory of place identity that they call 'place-related social identity' (PRSI), they hypothesise that communities with strong social and place identity will be more accepting of environmental (sustainability) attitudes and behaviours. The greater the sense of social and place identity, the greater the probability of sustainable behaviours. They suggest two distinct strategies for promoting environmental sustainability that have two models of social identity theory as their basis.

By comparing residents in two neighbourhoods in Guildford, Surrey, on measures of place identification, social cohesion, place satisfaction and environmental attitudes, Uzzell et al. (2002) found that social cohesion and place identification can influence PRSI, which in turn can play a key role in encouraging pro-environmental action. They therefore propose the theory of PRSI to explain that the negotiation of group processes with regard to the physical environment is an important consideration in promoting sustainable development.

Uzzell et al. (2002) use these two models to explain construction of social identity and show how they relate to 'place'. In doing so, they put forward four constructs: place identification; social cohesion; resident satisfaction; and environmental sustainability. Place identification is defined as "the characteristics of a place that give it a distinctive identity in the minds of residents". Place identification is suggested to aid social identity because place can have social categorisation conferring attributes.

Research on social identity is attributed to Tajfel, (1978; 1982), who looked at how people interact with each other in a social context. Tajfel and Billig (1974) showed that people will favour members of a group of which they are a member of, despite being randomly assigned to that group. How people identify with one group affects how they interact with other groups they see as different. Motivation for this comes from the desire to maintain a positive self-identity and to preserve self-esteem and if this does not occur, then people will try and leave the group or compare others in a less flattering way (Hayes, 2002). This process of social identification is referred to by Uzzell et al. (2002) as the cohesion model of identification. Following Festinger, Schacter and Back (1950), a group may be brought together in an urban environment because of physical proximity, shared lifestyle, or shared need (e.g. neighbours living in a street). This social cohesion, they suggest, leads to greater levels of place identity which subsequently leads to pro-environmental values and behaviours. Within this model, Uzzell et al. (2002) suggest that the weight of emphasis is on social cohesion with place identification and resident satisfaction being less important aspects of PRSI.

The second social identification model proposes that individuals favour groups via the process of self-categorisation. This refers to the process of identifying with salient characteristics within the group that mark it as different from an out-group whilst favouring the characteristics of the in-group. In applying this to place, Uzzell et al. (Ibid.) explain that emotional and value meanings associated with place, such as sustainability values that form via place identification, influence self-categorisation with a group and motivate an individual to conform to in-group behaviour norms, such as those that lead to sustainable behaviours. This second process of social identification is called the identification model and is attributed to Turner (1987). Uzzell et al. (2002) argue that this can explain place-related environmental values and behaviour. In this model physical aspects of the place may serve to enhance identity.

When considering the applicability of each of these models of PRSI to this current research, it may be that emphasis on place identification, or social cohesion could be relevant. It follows from Festinger et al. (1950) that tenants in Braunstone may be connected by physical proximity as perhaps opposed to shared need. There may be various possible groups that interviewees may or may not identify with such as: 1) new tenants living on the 'Six Streets'; 2) existing tenants living on the Six Streets; 3) tenants living on the wider estate; 4) PV tenants; and 5) non PV tenants. Additionally, it may be that measures of place identification are important in PV tenants' accounts of their neighbourhood; particularly as it has been suggested that place attachment is more salient in conditions of environmental transformation.

Uzzell et al.'s study was part of the City-Identity-Sustainability (C-I-S) Network, an international research project investigating the relationship between social life and sustainability within cities, in particular, the relationship between identity and sustainability. A C-I-S questionnaire used in the other C-I-S Network countries measured:

- Place identification (e.g. tenants were asked to identify environmentally significant features of their neighbourhood).
- Social cohesion (e.g. questions relating to participation in civic activities and social relations).
- Resident satisfaction on items such as environmental problems (e.g. pollution).
- Attitudes and behaviours towards environmental sustainability (e.g. such as evaluation of water as a resource).

One hundred and eighty residents in two neighbourhoods in Guildford, Onslow village and Stoughton, were interviewed. These two places were chosen because they differ in their population, quality of environment, residential history and individual identity of those who live there. Uzzell et al., (2002) describe that one has a social core, the other does not.

T-tests and chi squared scores were used to analyse differences between groups. A structural equation model was used to test the two models of social identity and the relationship between PRSI and sustainability.

Overall, they found a positive relationship between identity and sustainability in Stoughton, but not in Onslow. Onslow showed a negative relationship between social cohesion and sustainability. Overall, this suggests that different pathways to sustainability exist for different areas, supporting Uzzell et al.'s (Ibid.) claim that different places need to be considered separately if attitudes and behaviours towards the environment are to be understood.

Uzzell et al.'s (Ibid.) study and Stedman's (2002) definition of sense of place earlier in this chapter highlights that the nature of place meanings can be individual or common. For example, whether connection to a place is perceived solely in individual terms or has developed via shared meanings or other social dynamics may have a bearing on how individuals and groups react to an imposed change to their locale. Bonaiuto et al. (2002)

showed an interrelationship between social identity, place attachment and environmental attitudes surrounding perceptions of and beliefs about two protected areas in Italy. Similar to Uzzell et al. (2002) using place theory, the researchers set out to examine social-psychological concepts of pro-environmental attitudes and environmental concern from a 'place-specific perspective'. The study empirically confirmed a link between attitudes, place attachment and social identity and affective processes regarding the two specific areas, which suggests that identity processes may be implicated in attitudes to a place and environmental perceptions (in this case, perceptions of protection of natural areas). Differences in one area were found to be related to whether the perception of proposed change to the region was perceived as intrinsically linked to economic well being in the area (for those who took part in the study). One region had a long history of opposition to the institution proposing the change. These issues may be relevant in Braunstone given that the delivery of the PV project has been a top-down process. It raises the question, are tenants perceptions of and attitudes towards PV and the PV project affected by their perceptions of the project managers?

4.3.7 Environmental concern in low income groups

There is evidence of place attachment and place identity in residents' perspectives and attitudes to their local environment in a study of environmental concern in disadvantaged groups (Burningham and Thrush, 2001). Important to a preliminary review for this study is an understanding of how environmental issues are viewed by people living in low income groups. Using focus groups, Burningham and Thrush (Ibid.) investigated environmental interests and concerns amongst disadvantaged groups and their perspectives and understandings of environmentalism in four geographically distinct areas of the UK: 1) an urban locality; 2) a rural area of the Peak District; 3) an area in which people live close to a polluting factory in North Wales and 4) an area in which people live close to a busy road. They argue that the focus of research on environmental concern are 'green' values which are not broad enough to include attitudes towards the local environment and incorporation of social and economic factors. They therefore, adopt a broad definition of environmental concern within a

sustainable development perspective which integrates environmental, social and economic aspects of place.

The main findings from discussions with residents were that people on low incomes feel strongly about environmental issues in their local area and many concerns were area specific. For example, people living near factories worry about health and pollution and people in the countryside worry about poor transport strategies and disruption to community networks due to the rise in number of holiday homes. Pollution, the 'run down' state of the area and social problems were key concerns. However, many people talked with pride about the area in which they live and said that it felt like home. Some participants said that if they had won the lottery they would still choose to stay in the area. Older people reported more positive feelings. Feelings of pride and attachment relate to the psychological concept of 'place attachment' in Twigger-Ross and Uzzell's (1996) study of place identity processes. In their study, residents reported feeling proud of their area and did not want to leave. These issues are conceptually related to the identity processes of self-esteem and place related continuity.

Burningham and Thrush (Ibid.) also found that environmental terms were not easily understood by people amongst the sample and that the term 'local environment' was not used in framing local problems. Residents found phrasing of environmental terms confusing and the conversation always turned to local issues.

Global environmental issues were not easily understood although some residents did make the connection between local pollution and wider global issues and recycling was commonly mentioned. Another key finding was that people had little experience of local environmental initiatives and that any intervention that is unsuccessful may elicit further disengagement. This suggests that an initiative like the 'Solar Streets' project may have a positive impact on social inclusion if successful and that residents in Braunstone may discuss physical, social and environmental aspects of their local environment.

4.4 Conclusion

This chapter has reviewed work on psychological relationships with places and the role that psycho-social factors can play in influencing environmental attitudes, values and behaviours. The review was not an attempt at an in-depth look at how place theories have evolved, but instead provides insights on how place has been thought about in environmental psychology. The review has also shown how place related concepts have been used in understanding environmental attitudes.

The chapter began by noting that place is a contested concept within environmental psychology and that understanding people's relationships with places has been approached from two general perspectives: phenomenology and behaviourism.

As an alternative to these two approaches, the transactional perspective was introduced as an approach to studying person-environment relationships within environmental psychology with regard to the *social aspects* of place. A basic tenet of the transactional approach to studying place is that individuals' relationships with their physical environments are mutual.

A review of place literature shows that theories of how people form relationships with places have incorporated many (often overlapping and related) psychological constructs drawn from a range of frameworks (e.g. theories of identity and attachment). This has led to a lack of conceptual and theoretical clarity in addressing people's relationships with places.

Different theories and perspectives on how sense of place develops can shed light on processes involved in citizen involvement in how places are managed (Bott et al., 2003) responses to place transformation (or restoration) (Bonaiuto et al., 2002; Ryan, 2005; Tigger-Ross and Uzzell, 1996) behaviour and attitudes regarding the locale and wider global issues (Uzzell et al., 2002; Vorkinn and Reise, 2001) and other ecological features of places (Farnum et al., 2005).

Manzo (2003) notes that most of the more recent studies of place-people relationships used quantitative methods. Correspondingly, all of the studies reviewed in this chapter used quantitative methods. These studies administered questionnaire surveys to examine whether place variables were better predictors of local environmental attitudes than socio-demographic variables. The studies reviewed are unified in being carried out within the transactionalist research tradition.

An overview of theories and studies within the transactional perspective were introduced that have been used to explain and understand attitudes to specific localities, to imposed changes to areas, and attitudes to RET developments. These studies highlight place specific issues such as political autonomy and economic interests (Bonaiuto et al., 2002); social cohesion (Uzzell et al., 2002) environmental experience (Ryan, 2005) place attachment (Vorkinn and Reise, 2001) are key factors in human-place relationships. As such, these factors and theoretical frameworks may also be relevant to a neighbourhood such as Braunstone that is undergoing place transformation which includes the introduction of a RET.

Burningham and Thrush's (2001) study of environmental concern suggests that the term 'environmental issues' are not necessarily used or understood by low-income tenants in their discussions of local and global environmental issues. Similar to this study, the research reported in this thesis adopts a qualitative approach to further explore environmental concern in low-income tenants.

Overall, the studies reviewed show evidence that place attachment, social factors (such as social cohesion, social categorisation and inter-group processes), as well as physical characteristics of place, are involved in people's perceptions of and attitudes towards their environment and sustainability more generally. Therefore, it is possible that these factors may be important in understanding place issues in this study's context.

The theories applied to understand place relationships and how they may affect local attitudes have suggested links with other theories from social psychology. For example there is overlap in the studies between concepts from identity process theory, place identity and social identity (e.g. Bonaiuto et al., 2002; Uzzell et al., 2002).

Twigger-Ross and Uzzell's (1996) study suggests that identity process theory is useful when considering our conscious and unconscious relationship with the places in which we live and that place bonds may be more salient when a place is disrupted such as when undergoing regeneration. Therefore, it will be investigated whether the PV has any influence on Breakwell's (1986) four principles of identity.

The research sets out to explore how useful Uzzell et al's., (2002) PRSI theory is at identifying factors that have a role in influencing attitudes to PV. Using this theory, it is expected that aspects of the tenants' psycho-social or physical aspects of place may affects perceptions and attitudes towards PV, or, perceptions of solar PV may affect processes guiding psychological relationship with place.

As the Braunstone study is a qualitative study, it seems sensible to consider all of the possible components that may shape tenant responses to their surroundings and how, if at all, this affects their attitudes to the PV panels installed in their community. Therefore, Uzzell et al.'s (2002) broad conceptualisation of place relationships will be used because it incorporates many of the conceptualisations of place relationships, whereas other studies have examined place relationships with recourse to only one theory. This broader approach is deemed more appropriate for an exploratory study.

Uzzell's et al.'s (2002) concept of PRSI also incorporates the use of Breakwell's (1986) identity process theory which outlines principles that are theorised to guide identity and have been used in relation to understanding individuals' place relationship with an area that has undergone regeneration. These principles will also be included in the structure of the analysis as it was in Uzzell et al.'s (2002) study. Uzzell et al.'s (Ibid.) theory asserts a link between these principles suggested to guide identity processes and other

factors (e.g. place satisfaction which relates to Stedman's definition of place satisfaction) in understanding environmental attitudes.

Furthermore, Uzzell et al.'s (2002) theory has been applied similarly in an urban context and operationalisation of the four measures of PRSI provide a broad range of concepts that are seen to give equal emphasis to social and physical characteristics of place compared to other place theories by incorporating social cohesion.

Research and discussion of place is extensive, however this review shows that it has not been explored a great deal in the context of renewable energy and particularly within low-income groups. It is intended that PRSI, following Uzzell et al. (2002), will provide further understanding of the role of place issues in relation to renewable energy and whether or not PV influences self-identity processes.

5 **Research Methodology**

5.1 **Introduction**

This chapter presents the epistemology, methodology and methods used to answer the research questions devised based on these theoretical insights discussed in Chapters 2-4. Because the underlying philosophical principles and quality of the methodology have a bearing on assumptions about how we know the social world and the ‘knowledge’ produced by the research (Mays and Pope, 2000), this chapter firstly outlines the epistemological assumptions of the thesis. Then the research design and methodology are presented, outlining two stages of the research. This will involve detailing the research aims, the rationale for the methodology and data analysis method undertaken.

The main part of the study used semi-structured interviews to explore social housing tenants’ experience of PV systems in social housing at the pre-installation phase. Given that there is an absence of social research on experiences of solar PV amongst lower income groups (as highlighted in Chapter 2), a qualitative research design was felt most appropriate in order to provide a more detailed picture of attitudes towards and perceptions of PV. Once relationships had been established with PV tenants, a second phase investigated whether attitudes and perceptions changed over time. The second phase used a questionnaire survey of PV tenants.

A longitudinal research design was chosen in order to explore how experiences, perceptions of and attitudes towards the PV and the PV project changed over time. Within the DIT framework (discussed in chapter two of this thesis), both Lebay and Kinnear (1981) and Wisenbilt (1981), concluded in studies of solar energy diffusion in the 1970s, that barriers and incentives to adoption of solar technology are likely to change over time and therefore, longitudinal studies are necessary. Additionally, Klein (1983) and Sawyer and Wirtshafter (1983) used longitudinal designs in their surveys of first time users of domestic solar energy technology. For this study, interviews were conducted with PV tenants before installation of PV panels, and then a questionnaire

study three years after the panels had been installed was used to gather data at a second time point.

Before setting out the research questions and the research methodology for the study, it is useful to state its assumptions about the knowledge claims that can be made from the findings of the research. The epistemological position underpinning the research and the methods used to gather and analyse data needs to be clear to allow the reader to judge the validity of the claims based on those data. This chapter therefore begins with a discussion of epistemology and the epistemological approach taken in this thesis.

5.2 Epistemology

Epistemology is concerned with claims about the nature of knowledge. It relates to philosophical questions regarding the possibility of knowledge and different perspectives on what constitutes social reality (Hughes and Sharrock, 1997). Epistemology also asks questions about how reality can be discovered; what methods are used to access what is studied empirically.

Much social science research has been conducted within a framework that assumes that mental states can be measured and identified with confidence and that social data can be collected according to scientific method. As Henwood and Pidgeon (1994 p225) point out, scientific method “privileges the view of precise measurement (and hence quantification) alongside the (optimally experimental) control and manipulation of variables, in the service of the ‘objective’, empirical testing of theories.” For example, a number of the studies reviewed in Chapter 2 used questionnaires to investigate causal variables explaining attitudes to solar thermal technology to test hypotheses based on Rogers and Shoemaker’s (1971) model of innovation. The suggestion is that mental states exist and that confidence in these claims can be made with recourse to the classical standards of reliability, validity and objectivity. This is known as the postpositivist framework, which strives to conduct science broadly in accordance with

traditional positivist science of the nineteenth century (Cresswell, 2003), whilst at the same time recognising that studying human thought and behaviour is inexact.

The PhD research reported here is guided by a set of assumptions influenced by an alternative framework to postpositivism. This study seeks to understand subjective meanings of PV as experienced by PV tenants in Braunstone. In order to do this, tenants' perceptions and attitudes were sought using open-ended questions yielding qualitative data. The assumption was that each tenant will have their own meaning of PV and that using closed format responses would not allow these meanings to emerge. However, it was also expected that shared meanings of PV would exist amongst the 'Six Streets' community. This means that although PV tenants may have their own meanings of PV, resulting in multiple meanings, this research adopts an epistemological position similar to Miles and Huberman's (1994) 'transcendental realist' approach, somewhere between the postpositivist framework described above and an extreme social constructivist stance.

Miles and Huberman's (1994) view is that although individual constructions exist; social phenomena exist in an objective world as well as in the minds of the researched.

Following this, it was expected that consistent patterns in the way people talk about PV would be evidenced in the data, which would provide both theoretical insights into responses to PV within a local context and future implementation guidance for similar RET projects.

At the same time, it was expected that what people said may be influenced by real-world issues such as cultural meanings and the research process and thus, the data are not necessarily an exact reflection of what people thought. On this issue, Miller and Glassner (2004) discuss finding 'reality' in interviews and outline how the knowledge assumed by this study may be influenced by issues pertaining to the research approach such as: how the interviewees respond to the researcher given the different social categories that they may belong to; interpretation of meaning may vary across researchers; interviewees may not understand the questions; interviewees may not

answer honestly. These are relevant to the research approach used in this study and relate to debates concerning quality and trust in qualitative research.

5.3 An overview of the study design

5.3.1 Research questions

The main aim was to assess social housing tenant's perceptions of and attitudes towards PV systems. For this research the definition of 'perception' is taken from the *APA Dictionary of Psychology* "the process or result of becoming aware of objects, relationships, and events by means of the senses which includes such activities as recognizing, observing, and discriminating" (APA, 2007 p683). 'Attitude' differs in that it involves an evaluation. The APA states that an attitude is "in social psychology, a relatively enduring and general evaluation of an object, person, group, issue, or concept on a scale ranging from negative to positive" (APA, 2007 p83).

In respect to the main aim, there are some related sub-questions and the design of the study was structured with these in mind. In order to determine the social and psychological factors influencing attitudes to PV, and the Braunstone 'Solar Streets' Project, the research was designed to explore the following questions based on concepts discussed in Chapters 2 -4.

1) Does interpersonal communication across social networks influence attitudes to PV?
(DIT, Chapter 2)

2) Do tenants' perceptions of PV relate to the conceptualisation of perceived innovation attributes: relative advantage, complexity, compatibility, trialability, observability and risk? (DIT, Chapter 2)

2b) To what extent is relative advantage linked to the perceived financial benefit to the household of the PV panels? (Chapter 2)

- 2c) To what extent do basic aspects of living with PV, such as changing from a card (pre-payment) meter to a credit meter and changing to a new electricity supplier, affect attitudes to PV? (DIT, relative advantage, compatibility and complexity, Chapter 2.)
- 3a) To what extent are attitudes to PV influenced by perceptions of place? (Chapter 4)
- 3b) To what extent are attitudes to place influenced by PV? (Chapter 4)
- 4) Do issues of environmental concern relate to tenants beliefs about PV? (Chapter 4)
- 5) Do PV tenants' perceptions of and attitudes towards PV change over time, (from pre-installation phase to post-installation phase)?

5.3.2 Research design

Study 1 was the main phase of the research. Interviews took place to provide a detailed picture of PV tenants' perceptions of and attitudes towards the PV panels on their homes at the pre installation stage. A pilot study preceded the main interview study to test both the method and content of the interview schedule.

Semi-structured interviews were deemed appropriate to finding out meanings and perceptions and attitudes towards PV in a relaxed manner that was sensitive to the language used by interviewees.

This initial planning for the research considered using a combination of a multiple sort task (MST) (Canter, 1985) specifically to address understanding of household energy use and perceptions of renewable energy as well as a semi-structured interview to address attitudes to PV. For reasons that will be outlined, the pilot study revealed that the MST was not the most appropriate method to be used in the main study and that semi-structured interviews yielded more useful data. The pilot phase of the study therefore, was successful in helping to choose the most suitable method for the research.

To summarise, the study was characterised by three phases: 1) the pilot study: semi-structured interviews and multiple sort procedure (main study); 2) main study: semi-structured interviews and (3): questionnaire survey post-installation of PV panels.

5.3.3 Ethics

This study was conducted according to the ethical principles and guidelines of the British Psychological Society (1993). Therefore, participants were informed that their responses would be confidential and anonymous. Confidentiality was further assured by removing any identifying details from the interview transcripts and ensuring that data is kept securely, in line with the data protection act.

Participants were also informed verbally at the beginning of the interviews that participation was voluntary and that they did not have to answer any question that they did not want to. A transcript of this is available in Appendix 1. The researcher requested that the interviews be recorded and none of the participants objected. With regard to behaving professionally and respectfully towards participants, Greed (1990) discusses the idea of indulging in the safety and detachment of a 'hit and run', whereby the researcher uses the participants simply as a means to an end. The researcher's personal conduct in relation to this issue was to answer any questions about the research process and maintain a friendly but professional relationship. Frequent visits to the study site on a number of occasions were made between 2003 and 2007. Friendly conversations were had with tenants during these times.

5.3.4 Data analysis approach

In order to analyse the qualitative data, both the pilot interviews and the main study interviews were transcribed verbatim. Qualitative data analysis most often involves analysing text and many of the different approaches to qualitative inquiry (e.g. phenomenology, ethnography, case-study approach) are associated with an inductive approach to qualitative analysis. An inductive approach is in line with the classic

grounded theory (GT) approach (Strauss and Corbin, 1998), which aims to develop concepts and build theory by analysing data very closely without recourse to any preconceived theoretical framework. Sampling and data analysis usually occur simultaneously and theories are generated that are firmly based on interviewee accounts and explanations that emerge in the empirical data and are therefore 'grounded' in those data. Data collection stops once theoretical saturation is reached, whereby more comparisons and analysis of data reveal nothing new.

Data were analysed for evidence of the theories and concepts that are guiding the research project whilst at the same time, being sensitive to key themes or concepts in the data that may have otherwise been obscured if a deductive approach (a pre-specified theoretical framework) had been used. Miles and Huberman (1994), Noaks and Wincup (2004) and King (1998), amongst others, discuss qualitative analysis using this approach and set out a systematic procedure for reporting findings in the data that will be detailed in this chapter.

5.4 The pilot study

An initial small scale study was used to test both the method and the content of the semi-structured interview schedule.

5.4.1 Aim

The aim of the pilot study was to explore: 1) understanding of and attitudes to solar PV; 2) understanding of energy use in the home; 3) perceptions of renewable energy; and 4) whether or not people engage in pro-environmental behaviours. The pilot study allowed the researcher to become familiar with the method for the main study as well as helping to define the topic of the study and identify any problems associated with the research approach and methodology. In particular, it was tested for sensitivity to the language familiar to participants. This was particularly useful and important given that relatively

little systematic research has looked at attitudes to PV in low-income groups. The pilot study led to a number of changes in the development of the final interview schedule.

5.4.2 Rationale for multiple sort task (MST)

The pilot study set out to explore people's 'understanding of energy use in their homes' using a card sorting task: the multiple sort task (MST). The MST is a sorting process aimed at investigating people's conceptualisations of phenomena by studying how picture or word cards are put into categories (Canter, 1985). Unlike a survey, people can talk throughout the sorting task, putting forward their ideas on the issues being investigated. Canter (1985) argues that the MST allows people to express their own view of the issues under study without the influence of the researchers' opinions, and that the MST is better than structured response formats, such as the semantic differential, because it circumvents the issue of social desirability bias. This is where a respondent chooses a response based on what they feel they should respond, rather than on what they genuinely think. (Shaugnessy and Zechmeister, 1997) There are many ways of using the MST and many variations (Canter, 1985). For example, respondents can design the categories and the cards to be sorted (e.g. when the experiences being investigated are unique to the respondent) or as in this study, cards can be specified by the researcher and a free sort conducted by the respondent. In this case, the researcher has some influence on the categories in pre specifying the cards. To analyse a structured sort, content analysis can be used. It is also possible to use Multiple Scalogram Analysis (MSA), which clusters responses in a way that allows differences between groups or the difference between specified sorts completed by one person to be compared (Barnett, 1998).

The MST was devised following research by Qualter (1995) and Leggett and Finlay (1995) who investigated understanding of energy issues in children and adults respectively using pictures. It was designed to explore people's representations of electricity, for example how electricity is generated and transported, and people's perception of renewable energy. It was deemed to be a useful method given the

advantages outlined above by Canter (1985) and because it allowed for exploration of a complex topic without the need for sophisticated verbal skills.

5.4.3 Rationale for a qualitative approach

As outlined in the epistemology section of this chapter, research on attitudes to solar PV has predominantly been undertaken using a postpositivist approach concerned with the identification of factors that predict attitudes to solar thermal systems. For example, work described in Chapter 2 of this thesis by Guagnano et al. (1986) used questionnaires to establish the factors most likely to predict attitudes to solar thermal technology across groups of adopters and non-adopters. The results were found to fit Rogers and Shoemaker's (1971) model of innovation attributes that affect the rate of adoption of an innovation. Although questionnaires are a well established approach in psychological research and have been used previously to address attitudes to PV, this method may not be suited to understanding PV tenants' perceptions of PV prior to the implementation of a local PV project. Instead, a qualitative methodology was chosen for the reasons that are outlined below. Neither approach is right or wrong, but merely chosen to best solve the research problem. As Bell (1993 p6) reminds us, "the approach adopted and the methods of data collection selected will depend on the nature of the inquiry and the type of information required."

A qualitative approach was adopted for the following reasons:

1) Qualitative methods are associated with language and verbal reports. Consequently it was felt that the approach would be a better tool in providing a picture of the Braunstone context and tenants' subjective perceptions of the solar streets project and of solar PV. Georing and Streiner (1996 p492) define subjectivity as "meaning and interpretation as constructions that exist in the minds of people." Dey (1993) also discusses the use of qualitative methods for accessing meanings. He suggests that meanings are not just in the minds of individuals but are entrenched in social practices and contexts of individuals' daily lives. It was decided that verbal reports obtained during interviews

would allow for more flexible probing of “meaning and interpretation” and therefore provide a richer and fuller account of people’s perceptions and attitudes and the contextual factors that influence them. Arguably, the study could have been conducted using a quantitative approach but this may have incurred the problem of “overwriting internally structured subjectivities with *a priori* systems of meaning (Henwood and Pidgeon, 1994 p227).

2) Cresswell (2003) points out that a qualitative approach is often used when investigating a new topic of research. There is no research in the UK assessing social housing tenants’ perceptions of PV other than the Peabody study (2001) and as this is a new area of research, an open ended, flexible approach was thought to be a better way of understanding the research phenomenon and eliciting more information.

3) A qualitative approach was deemed to be more consistent with a flexible theoretical perspective. DIT started as the basis of the conceptual framework, but other theories may better explain what PV tenants think, or believe about PV. This inductive approach is consistent with the GT approach which involves studying a phenomenon without recourse to established ‘grand’ theories.

4) Qualitative studies have been conducted in this field of research before. Burningham and Thrush (2001) used focus groups and in depth interviews to investigate environmental issues amongst groups in disadvantaged areas of the UK. Also, Hedges (1991) used semi-structured interviews to examine people’s understanding of the concept of energy and energy efficiency in 80 households across the UK. In addition, Crosbie (2006) highlights the usefulness of qualitative methods in understanding household energy consumption suggesting that dominance of quantitative approaches constrains advancement in understanding the issues involved in adoption of energy conservation technology and behaviour. She suggests that “qualitative methods of data collection have the advantage that they provide the depth of data necessary for an analysis of the social and cultural factors that underpin energy consuming behaviour” (Crosbie, 2006 p741). Crosbie (Ibid) argues for the use of mixed methods whilst at the

same time being mindful of the constraints of using qualitative methods such as cost, expertise needed, time it can take to train researchers, level of participant commitment needed and the potential for self-report bias.

5) A qualitative inquiry was considered a more sensitive approach to capture the meaning inherent in the vocabulary and language used by the residents. Particularly in comparison to the much larger scale 1970s DIT surveys that are now considered as outdated and were used in a very different culture. This sentiment is echoed in Burningham and Thrush's (2001) study of 'disadvantaged' communities in which they used focus groups to examine meanings of environmental concern and opinions on environmental issues. Their study was conducted out of the recognition that existing research on environmental concern leaves 'disadvantaged' communities underrepresented, and that usual survey instruments used in research to measure environmental attitudes are not sensitive to local environmental problems and culture.

5.4.4 Method (Pilot Study)

5.4.4.1 Participants

A purposive sampling strategy was used for this study. Participants were LHA tenants in the houses chosen by the PV project managers to have solar PV panels installed, according to whether or not the houses were physically suitable. As such, the sample represented PV tenants available from 45 PV properties. As the LHA houses were being refurbished, participants were assigned to the houses on a first come first served basis. Participants were drawn from this pool of tenants.

The sample consisted of five tenants who were LHA tenants and due to have solar PV panels installed the week beginning January 5th 2004. Partnership meetings between Sundog (the solar installation company), Environ, and LHA established these first five houses.

The researcher asked participants if they would take part in a study intending to investigate people's attitudes to the 'Solar Streets' project and understanding of energy issues. None of the residents objected and dates and times were agreed on for the following week. Participants were sent follow up letters confirming the agreed dates and times of the interviews.

Interviews took place in participant's homes. This was deemed the most appropriate setting to conduct the interviews given that questions regarding PV, energy efficiency and pro-environmental behaviours were relevant to participants' homes. Houses were typically three bedroom, semi-detached ex-council houses with gardens that had undergone refurbishment as part of regeneration by LHA/BCA.

Before beginning the interview participants were thanked for taking part in the study. They were told the purpose of the study and the schedule for the interview. They were verbally assured of anonymity, confidentiality, that participation was voluntary and that they did not have to answer any questions that they did not want to. (A transcript of this is available in Appendix 1.) Participants were also asked if they objected to the interview being recorded. None did so. Ethics framing the study are detailed in section 4.2.1.

Interviews typically lasted 35 minutes. At the end of the interviews participants were thanked for their time and effort and informed that this interview was the first in a long-term study. Participants were asked if they would mind taking part in further research. A research journal was updated after each interview by the researcher noting emotional and professional responses to the interview as recommended by Arksey and Knight (1999).

5.4.4.2 Interview Schedule

The pilot interview schedule consisted of five main parts: first, factual questions concerning socio-demographic details of the participants; the next three sections asked about energy consumption within the home (e.g. “Do you have any energy efficient appliances?”); environmental behaviours within the home (a list was presented for the researcher to tick), and environmental awareness. The final section investigated individuals’ attitudes, perceptions and existing knowledge concerning the PV and the PV project. These questions related to DIT principles such as “have you spoken to anyone about the solar PV?” For the full schedule, see Appendix 1.

5.4.5 Multiple Sort Task (MST)

In the middle of the interview the MST was administered. For this procedure a total of 20 picture cards (15cm x 11cm) were used (see Appendix 2). Participants were first informed of the purpose of the sort, then asked to familiarise themselves with the cards and ask the researcher if they were unsure of what the cards were representing. The procedure comprised of two free sorts and two structured sorts. Participants were given instructions on how to carry out each sort.

5.4.5.1 Free sort

For the free sort, participants were asked to sort the cards however they liked into piles so that the cards in each pile had something in common. There was no restriction on the number of piles that could be made. Whilst constructing the piles, participants were told to feel free to verbalise what they were doing as they went along. Participants were asked at the end of the sort to tell the researcher why they had sorted the cards into the piles they had chosen (for full instructions see Appendix 1). The researcher noted the category label along with the list of cards in each pile and then asked the respondent to repeat the exercise.

5.4.5.2 Structured sort

In the first structured sort, participants were asked to make 6 piles of cards. One pile was to contain any cards that participants felt showed substances which were used to generate electricity. The second pile was to contain cards showing places where electricity is generated (e.g. power stations). The third pile was to contain pictures showing ways of transporting electricity (e.g. pylons). The fourth pile was to contain pictures of things that consume electricity. The fifth pile was to show cards that participants thought showed impacts on the environment from using electricity. The sixth pile comprised any cards that were unrelated to the other five piles.

Again, participants were asked to describe what they were doing during the sort if they wished. The researcher made a note of the card numbers in each grouping and participant descriptions were recorded

On completion of the MST, the semi-structured interview was resumed.

5.4.6 Pilot study data analysis

All five interviews were transcribed verbatim, although quality of recording varied for each interview and this proved to be a constraint on transcription of some interviews. The transcripts were marked “((can’t hear tape))” where this occurred.

Each of the transcribed interviews and MSTs were analysed for themes and coded. Some of the codes were based on the conceptual framework for the project and some of the codes were themes which emerged after consecutive readings of the transcripts. The main aim of the pilot study was to help inform the development of the final interview schedule. Because many of the questions were used in the main interview study, the pilot interviews were subsequently analysed along with the main study data. This procedure will be detailed under the main study method of analysis, in section 5.5.4.3.

5.4.7 MST results and conclusions

Although the MST yielded some interesting data, the number of questions and the amount of help needed to be given by the researcher actually detracted from the goal of the task. (For a list of problems arising in conducting the MST, see Table 5.1.) It was decided that participants understanding of energy issues would be better explored by semi-structured interview questions in the main study in order to make the task more straightforward for participants. Interviews were chosen to allow the conversation to flow according to the perspective of the participant and allow the perspective of the participant to be understood.

Table 5.1 Problems identified with the MST

Problem	Description
Problem 1	General confusion about what the pictures were showing. Participants not forthcoming with this at the beginning of the task.
Problem 2	Good for showing that people’s cognitive map of energy is fragmented and complex, however, it was felt it would have been better if people understood what the cards represented.
Problem 3	Participants had difficulties in grasping the meaning of the categories specified by the researcher e.g. “Please can you sort these cards into a category which best shows transmission of energy.”
Problem 4	Lack of space to conduct the sort comfortably in participants homes.
Problem 5	Participants found the task intrusive.
Problem 6	Participants felt patronised by the task.
Problem 7	Participants found it difficult to label more than one free sort.

5.4.8 Changes to the interview schedule

The pilot interview schedule changed because it was felt that the existing questions did not facilitate an in-depth discussion (indicated by the turn-taking nature of the interviews). Questions concerning individuals’ perceptions of place were therefore introduced to relax and steer the participant onto the issue of solar PV and because it was felt that participants relationships with their physical environment may be a variable affecting attitudes and perceptions of PV. Redundant questions were also removed or

refined. Despite these changes, the meanings of the questions were not affected overall and so analysis of these interviews was included in the data analysis for the main study.

The following changes to the interview schedule were deemed necessary in order to provide more meaningful data:

1. The MST was removed for reasons outlined above. It also broke up the natural flow of the interview.
2. Questions were made more open-ended followed by a list of probes, as they were too closed in the pilot schedule.
3. Questions on people's feelings about the area and questions regarding the home which reflected concepts of PRSI, were included in the beginning of the schedule as a lead into talking about the PV.
4. The checklist of environmental behaviours was considered too rigid and closed. Therefore, it was changed to one open ended question exploring environmental concern and awareness.
5. Topics were made more distinctive to avoid overlap.

5.5 Main study

5.5.1 Aim

The aim of the interview study was to investigate perceptions of and attitudes towards PV and the PV project prior to installation of PV panels. More specifically the interview study set out to explore: 1) understanding of and attitudes to solar PV and the solar panel project more generally; 2) understanding of energy use in the home; 3) perceptions of renewable energy; 4) whether or not people engage in pro-environmental behaviours and 5) perceptions and evaluations of physical and social place.

5.5.2 Main study rationale

The rationale for the methodology (interviews) for this study is the same as described in section 4.3.3.

5.5.3 Method

5.5.3.1 Participants

Participants consisted of the remaining LHA tenants due to have solar PV systems installed in their homes from February 2004.

5.5.3.2 Interview schedule

Following the changes made on the basis of the pilot study, 13 questions followed by probes made up the final interview schedule and covered the same topics that were asked in the pilot study. The order of the questions was changed slightly and a section was introduced on perceptions and evaluations of the area in which they live. Five main parts to the interview schedule were asked in a flexible order (see Appendix 3). First, questions were asked about perceptions and evaluations of the area and people's homes. This was a straightforward initial topic for aiding interviewees to talk freely and explored place concepts such as 'social cohesion.' This was followed by questions relating to perceptions and evaluations of solar PV and understanding of energy (which replaced the MST). The third section asked about environmental concern and awareness and environmentally responsible behaviours following Burningham and Thrush (2001). The fourth section asked about perceptions of and attitudes towards the PV project more generally. DIT concepts guided questions on knowledge of the PV project (e.g. "Have you talked to other people about the project?") At the end of the interviews, the researcher asked for demographic details from the respondents. The questions asked are shown in Table 5.2.

Fish (2002) notes that the wording of socio-demographic questions has received little attention in the literature on question construction in survey work. The socio-demographic questions asked are summarised in Table 5.2.

Table 5.2 Socio-demographic interview questions

Variable	Question	Response options
Age	Please can you tell me your age?	Prompt would be given if there was a pause, 16-24, 25-34, 35-44, 45-54, 55 or over.
Ethnicity	Please can you tell me what is your ethnic origin?	Prompt would be given if there was a pause e.g. "White or Black Caribbean."
Occupation	Do you work?	Yes/No.
Income	Please can you tell me your income or whether you're on benefits?	Four categories of ten thousand pound groupings. £0-10 000, £10-20 000, £20-30 000, £30-40 000
School leaving age	Please can you tell me how old you were when you left school?	
Environmental org. membership	Are you a member of an environmental organisation?	Yes/No.

5.5.3.3 Procedure

Thirty-eight households were contacted and a tenant asked if they would mind taking part in an interview intending to investigate Braunstone tenants' attitudes to the 'Solar Streets' project. All residents agreed and dates and times were set for interviews to take place the week prior to PV installation, in line with the programme of work for installing the PV systems. Data collection took place between January 2005 and September 2005.

However, it was not always possible to conduct the interview prior to installation. In two cases, PV systems had been installed but not commissioned by the time the interview took place. In one case, the PV was installed and had been commissioned. Nevertheless, these tenants were at the early stage of the PV project and so were included in the research.

It is notable that obtaining access to interviewees was complicated by difficulties in contacting them by telephone. Therefore, multiple visits to the study site had to be made in order to make interview arrangements. Maxwell (1996) suggests that the issue of 'gaining access' to participants is more complex than it sounds. He asserts that the

literature often gives the impression that once access is achieved, no further thought is needed, and that the term downplays the renegotiation needed in relationships with the people studied. Also, numerous visits to the site were needed even once access had been gained, to check and confirm interview arrangements. Some interviewees also forgot about the interview arrangements, so new arrangements needed to be made. This all meant that relationships with the interviewees were built over the research process, not just the one interview slot.

Access to two houses was not possible and other interviewees within the neighbourhood (either relatives or neighbours) were able to provide information as to why the tenants were difficult to contact. Maxwell (1996) suggests that gaining access rarely involves total success but that this does not necessarily hinder the researcher in obtaining the information needed to answer the research questions.

Another data collection issue was that once an interview had begun in some homes, other household members joined in with comments and responses to the interview questions. This was not seen as detrimental to the results of the study and instead is seen as part of the nuances of qualitative research. It was thought at the beginning of the study, following Klein (1983) and Lutzenheiser (1993) who suggest that solar technology is a male domain, that gender differences may influence the results. It was therefore hoped that it would be possible to talk to residents of both genders as much as possible.

Interestingly, during interviews that had been arranged with female members of the house, males would often interrupt as and when they wanted to give their opinions on the PV project. It was also common for women to invite the male to answer the questions if they felt uncomfortable about not being able to answer the questions. This was often where the interview schedule asked about how participants thought the PV would work. Males also interrupted the interviews to ask the researcher questions about the project. These interviews were treated as joint interviews and comments were assigned to the respective individuals and included in the transcripts. Therefore,

including the pilot interviews, 48 people were interviewed in total from 43 households out of a possible 45. One person was interviewed twice due to failure of the recording system the first time.

As with the pilot study, all interviews were conducted in residents' homes and typically lasted for 35 minutes. Residents' houses were felt to be the most appropriate setting to conduct the interviews for the reasons outlined in section 4.3.6. The interview followed a semi-structured format. This approach meant that respondents could give open-ended responses and raise any issues that they wanted to and also allowed the researcher to share factual information about the project as well as technical aspects of solar PV where appropriate.

At the beginning and the end of the interview the same procedure was followed as outlined in the pilot study in section 5.4.4. The only change occurred at the end of each interview, in that a contact summary form was kept.

5.5.3.4 Contact summary form

Miles and Huberman (1994) advocate the reduction of qualitative data in order to manage and analyse it. They provide a number of suggestions for data reduction in the form of various data displays such as a 'contact summary form'. This allows for brief description of main issues following an interview and any other issues to be noted in preparation for further contact to be made with participants. It was thought that given the large amount of qualitative data generated it would be useful for familiarising the researcher with the main issues quickly. A copy of a contact summary form can be found in Appendix 5.

5.5.4 Data analysis

5.5.4.1 Transcription

Both the pilot interviews and the main study interviews were transcribed verbatim. Two interviews were inaudible and so could not be transcribed. For these, the researcher wrote detailed notes from memory the same day of the interview.

Each transcript was typed using the following transcription conventions taken from the Jefferson (1984) system:

- [] Brackets indicate overlapping utterances between two speakers.
- ((chuckles)) Double parentheses indicate a sound or feature that is not easy to transcribe, such as ((laughs)) or ((pause)).
- () Single parentheses used to denote a period where conversation was inaudible and so could not be transcribed, or there was doubt about exactly what was said.
- YES Capitals indicate increased volume.
- = Where one speaker speaks straight after the other without a pause.

This transcription system was adapted according to what the researcher felt most facilitated the analysis. It was not felt necessary, for example, to time pauses or illustrate changes in intonation of the speakers as would have been the case if discourse or conversation analysis was being carried out.

Other conventions not taken from the Jefferson convention were used:

(*****) Used when names were mentioned in order to preserve anonymity of people in the neighbourhood.

(XXXX) Used where mobile numbers were given, again, for purposes of anonymity.

5.5.4.2 Coding

Analysing text involves making decisions about the meanings of words and coding is the method for doing this. There is a plurality of approaches on how to code transcripts. For example, the GT technique involves analysing data line by line and labelling themes according to 'categories', 'properties' and 'dimensions'. Categories relate to broad themes such as 'attachment to community', properties relate to a sub-theme of that category such as 'friendships in the community'. Dimensions give a range along which a property may vary, for example, 'having no friends' to 'having lots of friends'.

Other approaches to analysing text (e.g. Miles and Huberman, 1994; Noaks and Wincup, 2004; King, 1998) similarly involve reading through the transcripts and coding chunks of data. Robson (2002) notes that a template approach is a systematic data analysis strategy for qualitative data. Coding can either be the coding of discrete events or issues arising that relate to pre defined concepts (listed in the template). When using pre defined concepts, Miles and Huberman (1994) and King (1998) recommend the use of a list of a priori themes which can relate to the research questions defined in the initial stages of the project as well as the theories and concepts arising from the literature review stage. This list can be supplemented or codes can be dropped once data collection begins and new themes are found to be relevant (Miles and Huberman 1994). (To see a copy of the a priori codes that made up the initial template, see Appendix 4.)

Coding allows the organisation of data in a meaningful manner. Comparison of codes within and across transcripts enables themes and patterns in the data to become apparent. The goal of this approach is to interpret these themes and communicate them to a wider

audience. To do this, higher order codes are generated that allow for formulating and testing propositions that imply a conceptual structure that fits the data (Robson, 2002). Organisation, rigour and openness in the description of this process are necessary for evidence of a systematic approach to qualitative analysis. In order to ensure openness, a research journal was kept to record the exact steps of the analysis and also for reflection and learning.

For this thesis a review of strategies for qualitative data analysis from numerous authors led to this process being informed by King (1998), Dey (1994), Noaks and Wincup (2004), Miles and Huberman (1994), and Strauss and Corbin's (1998) procedure for GT. All of these strategies involve labelling themes based on the participants' accounts of their perceptions and experiences. King's (1998) 'template analysis' approach offers a flexible means of analysing qualitative data irrespective of the research methodology and its underlying epistemological position and was followed because it sets out seven clear analytical steps described below.

5.5.4.3 Method of analysis

Step 1 - Defining a priori codes: for this analysis, this applied to the topics that guided questions in the interviews such as 'perception of Braunstone or home' and 'opinions on environmental issues' and related to theories and concepts from DIT and PRSI discussed in Chapters 2 to 4. Importantly these codes could be changed or ignored if they were not later found in the data.

Step 2 - Initial coding: the next stage is to read through the data thoroughly to try and understand what they are saying. Coding allowed for categorisation of phrases or words in the interviews by assigning concepts or labels to chunks of text. Interviews were coded on a phrase by phrase basis using NVivo computer software package. Phrases varied from 0.5 to 6 sentences in length.

At this stage, codes can be created 'down' from research questions and interview questions and 'up' from the data. Codes may be easily described (e.g. "homelessness") or be more interpretive (e.g. "emotional attachment"). A GT approach here would encourage openness to the data by making comparisons between what the word appears to mean and other possible more abstract meanings by the use of 'memoing'. With this in mind, further readings of the transcripts were undertaken to check whether phrases or sentences could be labelled in other ways. Memoing provides a method for understanding how categories might link to together and link to concepts. At this stage, a journal was started that could hold thoughts on the data and the codes as the process continued. Within GT, memoing is encouraged as a way of relating ideas in the data to concepts or theories that are developing in the data and Miles and Huberman (1994) suggest that before refining the codes and the analysis that memoing allows the researcher to be open to analytic ideas. Memoing therefore was undertaken whilst making decisions about which categories and concepts were useful to the research questions and the issue being studied. A research journal document jotted all ideas down freely enabling the researcher to be open to gaining meaning from the data.

Initial coding was difficult because it is necessary that the phrases fit the codes and code labels exactly and this took time. As coding progressed, many codes were generated. The codes that were only used once were discarded or merged with other categories. Decisions had to be made concerning the relationships between the categories. For example, initially, decisions had to be made on whether the code 'perceptions of community identity' should be subsumed in the larger category of 'place' or should be a category on its own. This illustrates an important point, that many of the codes were interrelated.

Decisions also had to be made about the labelling of categories, for example, 'security' arose as a topic that relates both to an issue when talking about the Braunstone context as well as when talking about security of the PV panels. This meant that an initial template had to be revised very early on in the coding process because the number of codes being generated was unworkable. It was decided that the codes would be broken

down from 134 codes. After discarding a number of categories the structure developed into a more suitable template. Coding then resumed with any codes generated that did not fit the established structure being added to a list of 'free' codes. This was done with six interviews.

Step 3 - Inter-rating coding: before the coding template was modified any further, it was necessary to conduct an *inter-rater reliability check* to ensure that codes were not merely being applied based on the researchers' perceptions and pre suppositions (researcher bias). For this, a list of definitions of the initial codes were explained to a colleague from within the same field investigating perceptions and feelings towards public green spaces. This allowed for discussion during the exercise in relation to the theoretical framework guiding the coding. Place identity, place attachment, self-efficacy, trust and length of residence were concepts that were therefore discussed as was where they may overlap conceptually. Miles and Huberman (1994) suggest that following formula should be used to establish the level of agreement amongst coders.

$$\% \text{ reliability} = \text{agreements} / (\text{agreements} + \text{disagreements}) \times 100$$

At first 78% agreement was obtained but on discussion this rose to 90% because the coder did not fully understand the subtlety of the distinction between the codes "higher bills" and "saving money". Points raised by the researcher helped to develop the coding template.

Step 4 - Initial template: once more interviews had been coded, the codes were grouped together into a smaller number of broad themes. For example, ownership, size, garden, refurbishment all come under the concept of 'home'. This 'bottom up' approach to organisation of codes can involve more than two levels if this is more appropriate to the emerging themes. This code map was then used as the final template with which to label the remaining data.

Where appropriate, in line with Step 4, the coding template drew on the GT technique of labelling themes according to categories, properties and dimensions. Categories relate to broad themes such as “attachment to community”, properties relate to a sub-theme of that category such as “friendships in the community”. Dimensions give a range along which a property may vary, e.g. having no friends to having lots of friends. Figure 5.1 shows a representation of the codes from the final coding template which includes an example of both type of labelling.

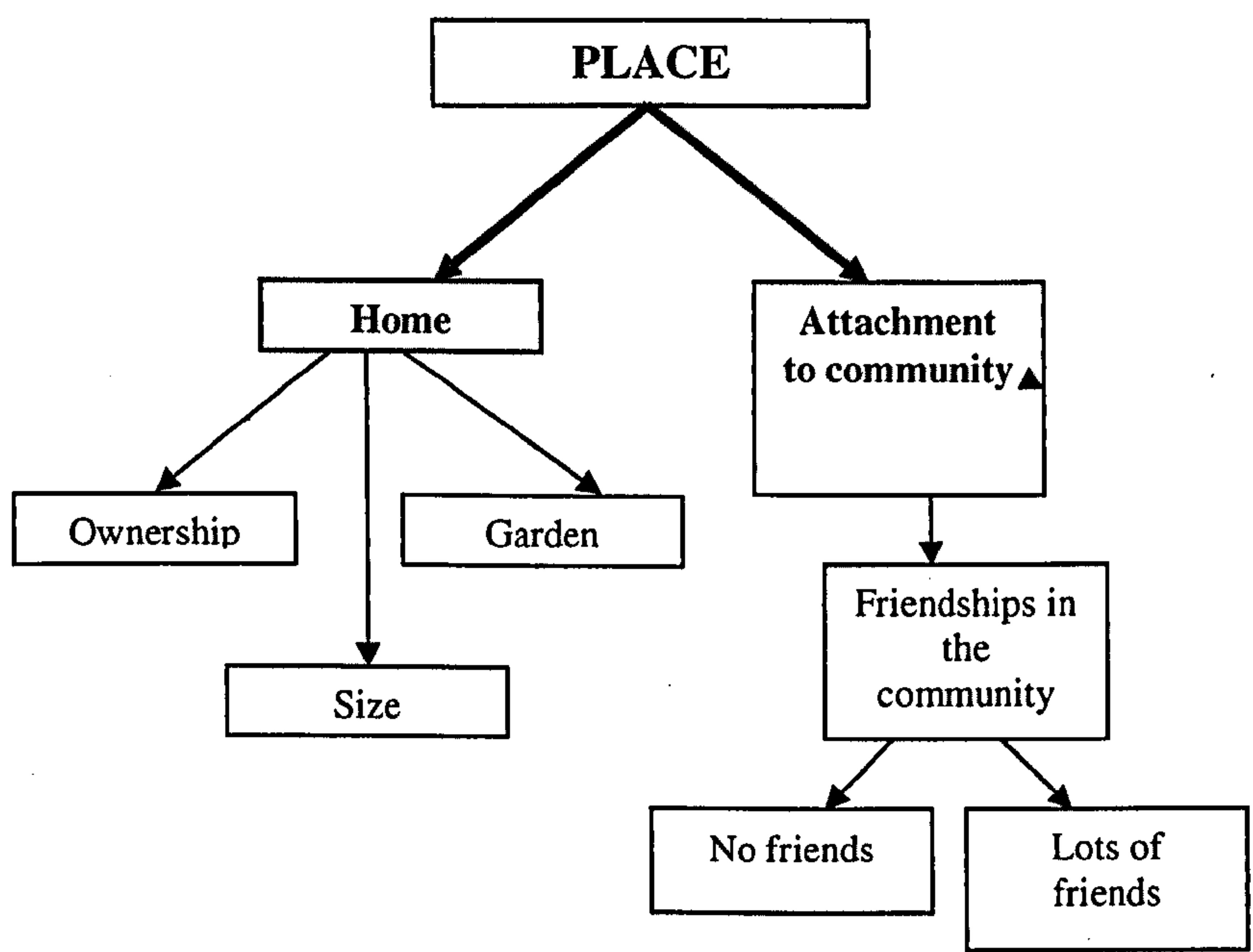


Figure 5.1 Representation of codes from the coding template

Step 5 - Develop the template: the coding template was applied to the rest of the data and the template was modified as new relevant themes were discovered. At this stage, codes can be added (insertion). Codes may merge with other codes or no longer be deemed relevant (‘deletion’), or the scope of existing codes may be redefined if they’re seen to have greater or lesser relevance to the study. Also, sub categories may move from one classification of codes to another. The research journal was used to note down where the template changed and why.

Recoding

To refine the coding even more, once the coding template had been finalised a concept map was made for each interview within Microsoft Word and a checklist matrix (Miles and Huberman, 1994) was made in Microsoft Excel in order to provide a sense of how many responses were coded within each theme. This allowed for data to be related more easily than was found possible in NVivo.

Step 6 - Validity check: step six of template analysis is to check that codes and relationships between them fit the data and that the findings are not biased by the researchers' expectations. In taking the transcendental realist approach set out at the beginning of this chapter, this research proposes that every effort should be made to maintain a systematic approach to qualitative data collection and analysis that is sensitive to reliability and validity.

Perspectives within qualitative research offer thought provoking discussion on the issue of assessing scientific rigor. Typically, critics of qualitative inquiry see it as 'soft' and lacking in scientific rigour. Validation in qualitative research is regarded as problematic because it does not produce generalisable causal relationships and reliability is said to be compromised because data are based on the subjective interpretation of the researcher. However, as Mays and Pope (2000) suggest that "subjective perception is involved in all research" and Goring and Streiner (1996 p494) point out that "although the techniques used by qualitative researchers to ensure the reliability and validity of their findings are different from those used by quantitative investigators, they do in fact exist, and they are as rigorous." Qualitative research is therefore increasingly regarded as producing warrantable knowledge claims that are plausible and credible.

Researchers such as Lincoln and Guba (1985) King (1998) and Mays and Pope (2000) offer guidelines for strengthening reliability and validity (credibility) of qualitative research such as *triangulation* and *participant validation* and use of *thick description* (providing a rich, detailed account of the data collected in order to give the reader the

best chance of judging reliability and validity). Other checks of validity are reporting of negative cases in the search for discrepant evidence and participant validation. These informed the stages of this empirical study where appropriate to the research context and research process, and helped develop valid findings from the interview study. For example, this study found that similarities in individual's accounts of their experience of PV existed both in the data and in interviews with project stakeholders and particularly monthly meetings with the housing officer. This allowed for triangulation of sources. Further, as will become apparent in the presentation of the findings, particular care was taken to report negative cases and search for discrepant evidence for what might be considered anomalous cases.

Step 7 - Interpretation and presentation: once all data have been analysed and a final template has been reached this can be used as a tool in writing up an account of the findings. Interpretation involves listing themes and summarising patterns between them (whilst taking care not to overlook individual cases) and prioritising particular themes that are most relevant to the research questions. Next, notes about themes, the use of case studies and illustrative quotes can be employed for writing up. Both searches run in NVivo and the checklist matrix within the Microsoft Excel spreadsheet were used in this process.

5.5.5 Summary

The chapter so far has described some epistemological debates within social research and the empirical assumptions guiding this study. This was followed by the research questions that influenced the design of the study and the details and challenges of the pilot work which tested the use of interviews and a MST. Next, a list of changes that were made to overcome the challenges of the pilot work was described, which set out the interview schedule for the main study. A detailed description was provided of the method of analysis in order to enable the audience to judge the interpretation of the qualitative data. Now this chapter sets out the research aims, strategy and sampling procedure employed in the second phase of the research.

5.6 Study 2

5.6.1 Aim

The second phase of the research used a questionnaire survey to address research question 5a:

Do PV residents' beliefs about, perceptions of and attitudes towards PV change over time? (From pre-installation phase to post-installation phase.)

A small-scale self-completion questionnaire was designed. In addition to research question 5a, the questionnaire sought to investigate some questions arising from the first phase of the research, such as whether understanding of energy generation changed as a result of living with PV.

The structure and design of the questionnaire was made as simple as possible for the following two reasons.

- 1) As highlighted in Table 1.1, levels of education in the area are low (LCC, 2001).
- 2) Information from key community members in the first phase of the research suggested that response rates for surveys in the area are typically low.

Despite this, a questionnaire study was the most appropriate method to collect data given that there was a clear understanding of the type of information required following the exploratory interview study. It was also seen to be the best way to gather information in a shorter time period than would have been possible if interviews had been conducted.

The questionnaire was based on findings from the main interview study. A total of 42 open and closed questions sought to provide information on the following areas: socio-demographics, information PV tenants had received; understanding of how PV systems work and energy issues more generally; how satisfied tenants were with their system;

perceived financial benefit incurred since the PV system was commissioned; relationship with the utilities; behaviour change; communication of PV across social networks; environmental concern (global and local), and; place attachment. A full copy of the questionnaire is available in Appendix 6.

5.6.2 Method

Once the questionnaire had been devised, it was given to the 'Six Streets' housing officer, who distributed copies to five residents. Two out of five of the questionnaires were completed and returned. Responses were deemed satisfactory as a means of gathering the necessary information.

5.6.2.1 *Participants*

Participants were selected on the basis that they lived in the 50 homes that had PV systems installed in the 'Six Streets' area. Since data collection for the first study, five new properties had been built and had PV systems installed. These were included in the sample. Forty-five questionnaires were given to the 'Six Streets' housing officer for distribution.

5.6.2.2 *Data analysis*

Thirteen out of fifty questionnaires were returned. Therefore, the overall response rate was 26%. On receiving the returned questionnaire survey, data was entered into a matrix within a Microsoft Excel spreadsheet in rows and columns. Responses to each question were recorded in columns against a row which corresponded to each respondent. Any missing data was identified as such. Totals for each response for each question were calculated.

Qualitative data was also entered into the spreadsheet for subsequent template analysis.

5.7 Summary

This chapter has outlined how the pilot study and the main interview study were implemented to answer research questions based on studies and concepts from the theories presented in Chapters 2 and 3. Details have been provided of the overall design, the sampling strategy, how the study was conducted according to ethical principles, information about the research sample and materials used and the procedures adopted. A detailed account of the data analysis approach was presented to provide transparency. Following this, study 2 was described detailing the rationale for the questionnaire survey, data collection and data analysis. The next chapter presents results from the pilot study and the main study.

6 Findings: Energy Awareness

6.1 Introduction

This chapter presents findings from the data analysis. Findings are presented and discussed in relation to Rogers' (2003) DIT and Uzzell et al.'s (2002) model of place-related identity theory where these theories provide a suitable framework. The findings suggest that conceptual links can be made between these two theories and the data are used to illuminate these links where they exist. A number of themes arose that did not relate to the two theoretical frameworks and these are also presented. Other theories that better explain themes in the data will be discussed where appropriate. Through analysis of the interview data it is possible to distinguish six major themes: energy awareness; interpersonal networks; lack of awareness of PV; relative advantage of PV (individual and collective), and; PV and identity.

To aid presentation, the findings are broken down across three chapters according to three broad categories. Firstly, data relating to energy issues are presented in order to provide information on tenants' understanding of energy and their opinions on environmental issues. This contextualises tenants' attitudes towards and perceptions of PV. Chapter 7 covers themes that arose relating to tenants evaluations and experience of place where this played a role in influencing people's beliefs about PV. In Chapter 8, themes relating to Rogers' (2003) attribute-perception model are presented. Findings are discussed and interwoven with extracts that reflect the main themes and sub themes to provide evidence of interpretation of the data. Names presented with quotations from the transcripts are pseudonyms to ensure confidentiality of the participants interviewed. Where an exchange is presented between the researcher and the participant interviewed, 'R' is the researcher and 'P' represents the participant. Summaries of findings are presented at the end of each chapter.

The findings illustrate a variety of cognitive and affective evaluations demonstrating the complexity of people's responses to PV and the PV project. Cognitive and affective

evaluations ranged on a scale from very positive to negative and therefore revealed a further dimension to the analysis in terms of whether participants explicitly expressed positive or negative evaluations of PV. Commonly, both positive and negative evaluations of the PV and the project overall were expressed by individual participants.

This complexity of participants' responses meant that data did not always all fall into neat categories. The findings group resident responses in such a way that minority and majority views will be discussed, but also, sole views of individuals will be presented where this is deemed important.

This chapter presents the broad theme of 'energy awareness' and related sub themes. This provides information on energy issues that are relevant to the practical parts of the PV project such as the installation of the PV systems. Discussion of these issues provides some insight into how aspects of the project affected tenants and whether these impacts affected subsequent evaluations.

6.2 Socio-demographics

The socio-demographic profile of the sample is first provided in Table 6.1. The majority of participants were white, female and in receipt of benefits. The data highlights that this sample of PV tenants is very different to the adopters of solar technology during the 1970s discussed in Chapter 2 who were educated, mostly male, technically minded installers of solar systems whose interest in the technology began a social movement (Hackstock et al., 1995).

Table 6.1 Socio-demographic profile of study 1 sample

Socio-demographic	Category	Frequency within sample* (individuals)	Proportion of sample (%)
Gender	Male	15	31.3
	Female	33	68.8
Age	20 or under	7	14.6
	20-33	33	68.8
	34-40	5	10.4
	41-50	2	4.2
	51-60	0	0.0
	Over 61	1	2.1
Employment	Full time	11	22.9
	Part time	3	6.3
	Unemployed	6	12.5
	Retired	1	2.1
	Other	27	56.3
Incomes	<£10, 000	9	18.8
	£10 001 - £20 000	8	16.7
	£20 001 - £30 000	3	6.3
	Not known	28	58.3
Children under 16	Yes	41	85.4
	No	7	14.6
Ethnicity	White	41	85.4
	White Irish	1	2.1
	Black African	4	8.3
	Black Mixed Race	2	4.2

* Frequency is based on data from a sample size of 48 individuals within 43 households.

6.3 Card meter

Twenty six participants used an electricity (prepayment) card meter and when they discussed the reasons why, they said that this was because they did not feel comfortable having to pay large bills. For example, when asked how easy or difficult she found paying her bills in the past Sue, age 20, said: “Now I’ve got a card meter, no problem, (pause) but before that it was like AARGH!”

A technical aspect of the PV project was that a credit meter had to be working in each of the 50 PV homes. Some tenants said that they were aware of this change, but other tenants first heard this information when the issue came up during their interview. Rogers’ (2003) discussion of technology clusters is useful here in that he raises the question, what are the boundaries around an innovation? Rogers (Ibid.) suggests that where one innovation stops and another begins is a matter for the perceivers of an innovation. In Braunstone the innovation was the PV panels, but these were also accompanied by new meters and a change to a new utility, therefore constituting a wider alteration of energy procurement.

Overall, participants were very accepting of changing to a quarterly bill for purposes of the solar PV project because they perceived that the PV systems would reduce their bills. For example, a common response was: “No problem if it saves me money.” (Harry, age 30). In addition, participants said that they were happy to change because having to top up prepayment meters when they run out is irritating.

Other responses expressed hesitancy about this issue due to budgeting reasons such as Sally, age 32 in the exchange below:

R: So, it would also mean that you wouldn’t be able to have a card meter, you would have to go over to a monthly bill. How do you feel about that?

P: Right, ((pause)) um, I’m not sure to be honest, cos I get my money weekly cos I’m on income support so it’s easier for me to put it in weekly. Um.

This expression of feeling more in control of payment of bills with a card meter can be conceived as a form of self-efficacy which has been suggested by Breakwell (1986) to govern self-identity. Self-efficacy relates to a person's perception of their ability to achieve their goals within their daily environment. The significance of this is that the change of meter for purposes of the PV project may present a threat to self-efficacy and would explain why some participants were particularly hesitant about the change to their normal way of paying their electricity bill.

It is interesting that such a significant change to PV tenants' electricity system did not create much engagement, interest or resistance from tenants despite pre payment meters being the most popular method of electricity bill payment. Changing meter was seemingly nested in the potential long-term financial relative advantage of having PV. However, this may have been related to a general lack of awareness and understanding of the technical changes involved. ('Lack of awareness' is a theme discussed in section 8.2.) An alternative explanation for this is that a change in energy technology is not deemed important because energy is invisible to people (Pasqualetti, 1999). Generally, energy is not seen as a priority for people but is taken as a given which does not usually require change or decision making.

Aside from these psychological issues, the impact of changing to a credit meter has behavioural implications such as a change in how people will pay for their electricity and whether or not they will engage with the new PV meter (which indicates the quantity of electricity generated by the PV system). These behavioural aspects of energy consumption are often discussed within a socio-technical perspective to understanding energy use (e.g. Lutzenheiser, 1993) and are relevant to understanding how end users engage with PV. A related issue is that the institutions responsible for the delivery of the project are responsible for where the meters are situated in the house. This may determine the level of interaction between the householder and the PV system.

6.4 Switching electricity supplier

As well as switching electricity meter, another household change in energy procurement was a switch to a new electricity supplier. Similar to responses to changing electricity meter, not all tenants had heard of 'Ecotricity', the prospective electricity supplier and overall, participants were happy to switch supplier because of the expected benefits to having PV. For example, John, age 42 said: "If it's going to save me money I'll change to whoever".

Concern about the cost of electricity supplied by 'Ecotricity' was expressed by some participants such as Jose, age 22: "As long as it's cheaper. We go for the cheaper things yeah?"

Eleanor, age 21, similarly said:

She [housing officer] just said they're not con artists, I said, no, no, no I know this, but it's just do you know what I mean, I need to know how much I'm using, I'm used to my electricity company, changing electricity company's gonna be, you know, I need to work out the difference and that as well.

Overall, participants' understanding of a change to energy procurement as an aspect of the project was not very high which points to the need for more information to improve awareness of the more technical aspects of the PV project. It is possible that the tenants who were unaware of the changes to energy procurement were so because the person responsible for imparting information about the project did not know this information at the time of speaking to the tenants. Or, it could be that residents were told, but had forgotten this information by the time of being interviewed.

6.5 General understanding of energy

6.5.1 Electricity bills

There were mixed responses to how much people reported they spent on electricity. A number of residents said their bills were very high but 16 residents said that they spent between £4 and £6 per week on electricity and this was not deemed to be a problem. For example, when discussing bills Emma, age 21, said: “not that I struggle with my bills”. Similarly Elanor, age 18 said: “I don’t really spend much on my electricity bills”. This finding is interesting because it has been reported that people in this socio-economic band spend a disproportionate amount of income on their energy bills (Herbert and Kempson, 1995; Boardman et al. 1999). For this latter group, either this cost is genuinely not perceived to be very high or it could be that participants did not want to admit to the researcher that they struggle to pay their bills.

Some participants said that they did not know how much they spend on electricity because they have got a card meter. Kempton and Montgomery (1982) discuss ‘folk quantification of energy, suggesting that people see energy consumption in terms of financial cost, rather than in energy units. This finding suggests that even quantification in terms of financial cost is difficult if electricity is paid for via a card meter. This may strengthen the argument for clearer billing information from energy providers and the use of domestic energy monitoring equipment in order to help people to understand how much energy they use.

Most respondents said that they expected to save money on their electricity bill once the solar panels were installed. The majority of residents mentioned they were hoping their bills would be reduced by 25% to 50% as reported by Emma, age 21:

R: How do you think having solar panels is going to affect your electricity bills?

P: I think it will decrease it I think, not that I struggle with my bills but if I use about four pound a week I reckon I’ll use about two pound a week.

One tenant whose PV system was already installed and commissioned by the time he was interviewed discussed that he had already had a bill and was extremely pleased that his bill had reduced so much: “So all of a sudden I started to get 300 pound bills. Now, 43 pound. Make my day. I heard 28 pound next door.” (Eric, age 39)

This suggests that Eric and his neighbour were already benefiting in terms of relative economic advantage over their old system. (Relative advantage is discussed further in Chapter 8.) Eric noted that he had personally thanked the chief executive of LHA for installing solar PV on his home.

6.5.2 Perceptions of electricity transmission

When asked the question “where do you think the electricity you use in your home comes from?” Eric, above, answered: “I think from the solar panel isn’t it?” This relates to Pasqualetti’s (1999) suggestion that embedded generation of electricity increases the psychological salience of power distribution compared to a centralised system of power distribution. Bahaj and James’ (2006) study of PV systems in social housing also suggests that one of the benefits of PV, over other microgeneration technologies, is its ability to raise awareness of energy issues, such as electricity use at the point of generation. This initial response from Eric appears to support this notion at the post-installation stage. Further research could explore whether more participants make the same connection.

In contrast, all the other residents gave mixed responses to where they thought the electricity they use comes from, the most common being ‘I don’t know’, or ‘the electricity supplier’. For example, Elaine, age 22 said: “Em, to be honest, I really don’t know. I think ah, electricity, that’s good, but I’ve never really thought, you know, where it actually comes from. To be honest, the answer’s I do not know.” A small number of participants answered: “pylons” and “power stations”. This suggests that participants do not link energy to its source and supports findings in other studies that suggest that energy use is a fragmented concept (e.g. Hedges, 1991; Qualter, 1995).

Although all of the residents understood that PV will generate electricity, no comments were made suggesting that decentralisation of energy was deemed a key characteristic of the PV system. This is in contrast to the findings of research during the 1970s presented in Chapter 2 which suggested that self-sufficiency from electricity monopolies was a factor affecting attitudes towards solar thermal systems. However, this difference is perhaps explained by the differences between the study samples (i.e. voluntary vs. non-voluntary adopters), the context of the 1970s energy crisis and general anti-establishment cultural movements.

6.6 Energy efficiency

Eighteen participants said that energy efficiency is important to them and the main reason for energy efficiency behaviour in the home was to save money as suggested by Fred, age 81:

R: How important is energy efficiency to you would you say?

P: Well pretty, it does, coz I be a bit careful coz if the room gets really hot and that, I shut it off, that saves you money see, basically, otherwise you could waste a lot.

Similar to Fred, Noreen, age 22, also highlighted that financial motivation may be particularly relevant to people in social housing by highlighting the implication of energy use for low income families:

So yeah it is, and obviously you're not wasting electricity, like cos we're on a pay as you go meter as well, you've got to think about that all the time, well I have done in the past anyway. And obviously I'm a single working mum, but of course that's important, I don't want to have something where I'm cooking and it's just going to waste, that's no good to me.

This component of participants' motivation for energy use patterns may be a factor underpinning the clear interest that emerged in the data in gaining financial benefit from the PV installations.

Turning lights off emerged as the most common energy saving behaviour that participants perform. Turning electrical appliances off at the plug socket was also mentioned.

An additional pattern emerged with some participants reporting that they switch lights off or do washing at night because they have always been brought up to do so, therefore energy saving behaviour was performed automatically out of habit. This implies that energy related behaviours may be deeply rooted in past experiences such as upbringing as suggested by Lucy, age 23:

I always, well not today, but I always turn everything off at the plugs. Just to make sure that none of the things are, my mum always taught me to er, always at night when I, watching TV, I turn the lights of and watch it in darkness, I just try and save it.

Tracy, age 27, discussed energy efficiency in respect to childhood experiences:

Do you know what, I suppose with a lot of people, if you're brought up in the kind of environment where people around you are quite energy efficient then it's going to rub off on you. I think, I'm not saying that I've got bad parents, but you know, I was never brought up to be conscious about those sorts of things, not saying that we had electricity on tap or the gas fire blaring but like, I've never been brought up in the environment where I've been fully conscious of it.

This may be linked to the apparent economic situation of participants in the case study site. These findings add support to the finding that participants on the whole were happy to switch from a pre payment meter.

When asked about whether they see energy efficiency as having an impact on environmental issues, most participants said no or "not really". A typical example can be seen through the following quotation from Mary, age, 20:

R: Do you see energy efficiency impacting on environmental issues?

P: Not really, not really I don't really get into it if you know what I mean. I just use my electricity and that's it.

Participants who did respond with "yes" were often unable to elaborate when probed by the researcher. Overall there was a lack of connection between energy efficiency and the environment across the participants, and if participants did make the connection, in general, they were unable to coherently explain the reasons for the connection.

6.7 Environmental concern

Overall, patterns in the data reflecting environmental concern replicate findings from Burningham and Thrush's (2001) study of environmental concern in low-income groups. They found that it was difficult to get participants to talk about global environmental issues but that those who did discuss it mentioned a range of issues. Included in this was concern for future generations.

In this study, 21 households responded that they did not have any opinions on environmental issues such as Anita, age 24:

R: What are your opinions on environmental issues?

P: I ain't got any thoughts on the matter at all to be honest.

However, amongst the 11 households that did express environmental concern, a wide range of global environmental issues were mentioned such as GM foods, depleting fish stocks, famine, the ozone layer, glaciers melting, depletion of natural resources, saving animals and methane from cows. Similar to Burningham and Thrush's study (2001) the ozone layer, pollution and rainforests and animals were mentioned most frequently. The terms global warming and climate change were less understood and participants commonly responded that they did not know anything about these issues. In addition it was common for people to talk about the ozone layer when they were asked about global

warming. For example, when asked about the impact of energy efficiency on environmental issues, Elsie, age 28:

R: Do you see energy efficiency impacting on environmental issues?

P: Yes! Um, I don't really understand the thing about the ozone layer. But I know it's connected to it and for me I know how important it is, the fact that temperature's, summers are suddenly getting hotter, so that in however many years it's going to be like abroad. And then it's going to get worse and then the things are going to melt and see I do get the gist of some of it, I do, and then we're going to flood and Britain's so small compared to the rest of the world, we're ((pause whilst trying not to swear)) in a mess ((laughs)).

Confusion between the ozone layer and global warming was a common pattern across the interviews. This may suggest that more established, high profile environmental concerns of previous decades (i.e. rainforest deforestation and ozone layer depletion) are more salient environmental issues in participants' minds than climate change which could be considered a more contemporary issue. This suggests that representations of environmental issues are not changing much amongst this group. In other words, understanding of familiar environmental issues have not changed to incorporate more recent environmental problems such as global warming. This may have changed since the data collection period however, given the considerable increase in climate change communication and media coverage of environmental problems over the last three years.

When asked about global warming, Elsie also discussed concern for her children:

I am bothered, I worry because I've got children and I'm not going to be around to protect them forever and you know, I've got to teach them and if I don't know myself...and then I get into a mad panic and I think God, when I'm not here, how are my children and their children, because whatever I teach them, they're going to teach their children in generations to come, and all we're teaching them is how to ruin the planet, it's mad.

6.7.1 Environmental behaviours

Recycling emerged as being the most discussed environmentally responsible behaviour. Thirteen participants, such as Jo, age 19 mentioned recycling when asked if they did any environmental activities: “I would say I like to try and help but I know, it sounds silly, you know, everything is on standby because it’s easier for me. Um, so I sort of contradict myself, but then I do recycle.”

Participants commonly discussed recycling with frustration because there had not been a recycling facility in the area for some weeks and the old green bag system was reportedly much better because it was bigger and children don’t steal them.

These findings support Burningham and Thrush’s (2001) finding that recycling is commonly discussed by low-income tenants. A potential reason for this may be that recycling is already a well established form of environmental action within the community. The local authority provides recycling facilities for each home and frequently promotes recycling to reach its statutory targets. Therefore, recycling may already be an aspect of participants’ lifestyles. On the other hand, energy management does not necessarily receive the same level of attention within local communities.

6.8 Summary

The themes on perceptions of electricity and energy use provide important context to understanding people’s level of awareness and understanding of general aspects of electricity and how these would be affected by the PV project. Participants were seen to have different levels of awareness and attitudes towards the changes required to their existing electricity system in order to have the PV systems installed and commissioned. Of those who were aware, responses, as illustrated above were clustered into three groups: 1) happy to change (John and Harry); 2) open minded, because the panels should save them money but concerned about the costs (Jose), and; and 3) not happy to change, but will think about it (Sally). Out of 26 people who said whether they had a card meter or not, 19 said that they were happy to switch to a quarterly or monthly bill.

There was suggestion from a minority of respondents that changing from a prepayment meter to a card meter was deemed negatively because pre payment meters are a budgeting aid. It was suggested that this may present a threat to tenants' self-efficacy. Overall, most people were happy to accept the changes to their billing and electricity systems because perceptions of these technical changes were secondary to expected financial saving.

Evidence from one participant (Eric) suggested that solar PV may have the potential to connect people with the source of energy in their homes.

Responses reveal that prior to the installation of the PV there is generally a lack of connection between the environmental consequences of energy use. There was difficulty in getting people to talk about environmental issues which relates to Burningham and Thrush's (2001) work. A pattern emerged whereby many participants said that they didn't usually think about it. Also, there was confusion about global environmental issues. Residents do consider global issues in terms of finite resources and a range of issues were mentioned. Also, recycling is the most regular action taken by the participants in terms of pro-environmental behaviours. Lack of resources to recycle proficiently was commonly noted.

7 Findings: Place

7.1 Introduction

It emerged from the transcripts that communication channels were the way that people learned about the PV project and the means by which impressions of the solar panels had been formed. They are therefore a key factor affecting the degree of knowledge and understanding that residents have of the PV. Within DIT, Rogers (2003) describes how communication channels are the means by which information transfers from one individual to another and in this study, this occurred (in the minority of cases) via local media, but more commonly, via interpersonal, face to face contact. From the analysis it can be seen that personal communication between residents and other people regarding the PV project could be categorised as a) interpersonal communication with people in the neighbourhood; (homophilious networks); b) with peers outside the neighbourhood who were similar to the PV residents in terms of socio-demographic profile (homophilious networks) and critically; c) with the housing officer or other actors outside of the community who typically form a different social network to the 'Six Street' residents such as the project institutions and staff at the nearby environmental show home (heterophilious networks).

7.2 Interpersonal networks

7.2.1 Social cohesion

Although the *in vivo* code (an *in vivo* code is a label for a code that uses the exact words used in conversation by participants) I "keep myself to myself" (Ali, age 29) emerged as a theme across five interviews. A larger proportion of interviewees commented on the "close knit" nature of interpersonal relationships in the neighbourhood based on evaluations of the area both before and after the regeneration work took place.

Connection with others appeared overall to be neighbourhood based and in general, residents reported a strong sense of community within the area. Contacts were described within the Braunstone Social Club, with the BCA, neighbours, friends, family networks, Sure Start (the government funded programme that provides childcare alongside education, health and family services [Sure Start, 2008], the local housing officer and other LHA staff. A feature of the PV project was that it provided local employment in the area and four of the tenants interviewed also mentioned that they knew the person who was employed to install the solar PV on each house. This network of contacts reflects Uzzell et al.'s (2002) notion of social cohesion which describes how a group of people come together as a result of physical proximity or a shared lifestyle or shared needs within an urban neighbourhood and Clarkes' (2007) discussion of sense of community within the traditional urban neighbourhood.

Caroline, age 23 said:

Er well there's a girl up the road, I know her, she's on Hollins, so that's (XXXX), and I've got a friend up the road at the bottom, that's (XXXX), so I am within my friends you know, radius of my friends, they live quite close.

Diane, age 24 in the following exchange said:

R: What do your friends think about you having a solar panel? Have you spoken to anyone about it?

P: The only friends I've got are the friends around here, and they're having it anyway ((laughs))

Ali, age 29 commented on how close and friendly the neighbourhood is:

I think it's quite close. I think people sort of, I mean like I've only been here seven months and already I know quite a few people on the street, sort of not like not on a first name sort of basis but everybody says morning are you alright? And everybody's quite friendly and I think people sort of look out for one another. You know if anything's going out on the front then the

neighbours are out and say is everything OK, they're checking so I think that's quite nice. Coz at first I thought, ooh, I'm going to sort of keep myself to myself and not get involved with people and then, I know I'm going to be alright. But, everybody's that friendly that you end up saying hello and having a chat and it's quite nice.

In contrast, older tenants such as John, age 42 commented on the new people who have moved into the area (who had lived in Braunstone all his life) suggesting that it had eroded the social cohesion:

The people, if you know them, obviously not this particular bit because eh, most of them are quite new, but uh, the older people of Braunstone are really nice and all quite friendly and everybody knows everybody you'll find ((chuckles)).

Similarly, Eric, age 39, said:

Parts of it does, problem is with people moving in, you don't know who's who like, I don't think they know who's who, so, really it's just two sides to the estate now.

Diane, age 24, was also a longer-term resident; she suggested that the influx of new people had not made any difference when she said:

Well it's weird because there's not a lot of people from Braunstone that are around these streets. Not that I know of anyway. But they're nice people, so you get on with everybody round here.

Both old and new residents expressed different feelings regarding the regeneration and said that community tensions exist within the area as a result of the 'New Deal' funding. Overall, these findings highlight the nature of the area being in flux and transition.

7.2.2 Perceived homogeneity

As well as descriptions of social cohesion in the area, there was also evidence of Uzzell et al.'s (2002) concept of 'perceived homogeneity'. Perceived homogeneity refers to

perceived similarities between neighbours and serves to support social cohesion. Tenants described themselves as similar to other tenants in the area such as Donna, age 35:

Well in the same sort of circumstances, I mean, I know along here we're all single mums, you know so we're all exactly the same, there's not somebody on the end that's got four cars and two kids and somebody the other end with no cars. It's, we're all about the same which is nice.

Further, there was evidence to suggest that perceived homogeneity of residents who live in the 'Six Streets' affected positive attitudes to PV. For example, some residents saw PV as benefiting "people like me" (this is discussed further in Chapter 8). Perceived homogeneity is related to a social-psychological concept known as social categorisation, whereby individuals use social information to classify others who are similar or different to themselves on certain characteristics (Manstead and Hewstone, 1996). The process of social categorisation is the basis of social identity theory which has been used to explain inter-group and intra-group processes such as conflict and prejudice. This finding adds to literature suggesting that identity has "place related implications" (Twigger-Ross and Uzzell, 1996 p206).

7.2.3 Social participation

Social activities were mentioned by 25 participants, but involvement on a practical level was varied. Attendance at 'Sure Start', 'make up days', education courses, Braunstone local radio, the Residents' Association were all mentioned across the interviews. Letters through the door was the most common way people heard about the activities.

Evidence for participation in activities was seemingly low in this study. This can be explained by the fact that people had not long lived in their homes and were still getting used to the area. Moreover, following Uzzell et al.'s (2002) assertion that levels of participation have been found to be related to levels of deprivation, perhaps regeneration in the area deflects the need for participation that might have otherwise been evident as a result of activism in the face of poor environmental conditions.

7.3 Interpersonal networks and PV

Devine-Wright and Devine-Wright (unpublished) found that interpersonal networks and social characteristics emerged as important aspects of attitudes towards a community wind farm. In this study, participants' responses were varied as to whether the panels had been discussed with peers.

Some participants said they had not discussed the PV at length with anyone as illustrated by Sue, age 29 below:

R: What did your family think about you having the panels on your roof?

P: They haven't said a lot.

R: Right

P: With me mum it's sort of like her with one of her hair brained schemes. ((laughs)).

Similarly, Alan, age 26 said, "they haven't really said much, they just said is it going to save you money? And I said I hope so and they went, good on ya, that's about it".

In contrast, Elsie said that she had spoken to everybody about it:

R: Have you spoken to anyone about the fact that you're going to be living with solar panels?

P: Yeh-eh, everybody, and the main thing that everybody goes is oooh, is that cheap electric? ((laughs)) and of course, the biggest concern is like, OK, this is Britain, how big is the sun's rays?

Overall, positive remarks from friends were reported. For example, Amy, age 22 said, "they just think it's new and exciting."

In contrast, four participants said their friends made negative comments or were sceptical as illustrated in the excerpt below by Annie, age 19:

They don't really think much of it...They don't think they're worth it. She don't trust em...my family think it's a stupid idea as well.

That PV had been discussed in some cases more than others may correspond to the different levels of awareness of the project reported by the participants. Overall, despite the sense of community discussed by participants, there was little evidence that communication influenced attitudes to PV. Further research could assess whether this lack of evidence for communication across homophilious networks changed over time.

Influence of direct communication with friends did emerge however in cases where friends had seemingly directly influenced respondents understanding of solar PV. Eleanor's friends apparently influenced her beliefs about solar PV:

Well, I went for my interview with two people and they both knew about them, and they seemed quite excited. They had to explain them to me. I don't really know anything about them (Eleanor, age, 18).

She later said: "It should help with my bills. The weather shouldn't affect them. When my friends were explaining to me about them, they told me it was like a calculator. Coz they work with light."

Eleanor's reference to social networks and in particular the phrase, "they told me it was like a calculator" is evidence of the psychological process of accommodation suggested by Moscovici's theory of social representations (2000), which in broad terms explains how shared communication within social groups facilitates something unfamiliar to become part of commonsense understanding. The theory focuses on the internal psychological mechanisms by which something unfamiliar becomes 're-represented' via 'anchoring' and 'objectification'. Anchoring is concerned with modifying existing mental structures to assimilate an unfamiliar idea. A new representation (e.g. a solar PV panel) joins existing objects and meanings that are in some way similar such as a solar

powered calculator, or a sun roof which is said to occur via objectification (accommodation). This helps understanding of the new object. From the transcripts, it can be seen that people were constructing the meaning of PV using metaphors such as sunroof, skylight, sunbed and calculators.

Beliefs about sun roofs and sun beds were evident in Jane's (age 21) conceptualisations of solar PV in the exchanges below, further illustrating data suggestive of this psychological process:

R: How do you think it will affect your house?

P: Hopefully it will be cheaper.

P: It's just like it's got a sunroof on it.

R: ((Laughs)).

Alan, age 26 also says:

R: What do you know about solar photovoltaic panels?

P: Nothing.

R: Right.

P: They come in calculators. That's all I know.

DIT posits that types of social networks and types of social systems are linked to the rate of the adoption of an innovation. Interpersonal networks convey information about an innovation, which has the effect of reducing the uncertainty about a new innovation. Although the concept of social networks does not correspond to rate of adoption of PV in Braunstone in the typical sense, because the decision to adopt has been made already on behalf of the tenants, Rogers' (2003) discussion of homophily and heterophily is nonetheless useful in understanding the way information about the PV project was conveyed and how communication about PV and the project took place.

7.3.1 Jealousy

The most striking finding across the transcripts relating to interpersonal networks was that residents in the PV homes had friends, relatives or neighbours that were jealous that

they are not getting PV. Alan, age 26, explained that this was because of the financial benefit of having PV:

It's like if they've got it and next door hasn't got it then they'll say why has he got it and we haven't got it coz they're being charged for the electric and I ain't ((laughs)). So they could be annoyed they might think it's unfair they ain't got it.

Lucy, age 23, similarly said about her sister "Well, firstly my sister was like, oh wow, free electricity in the day, why don't they do them to our houses".

Jane, age 21 commented "Um well me friend Carrie, she's me friend next door, she's like really jealous over it because she lives next door to me and she hasn't got it."

Some participants reported that jealousy had seemingly been experienced firsthand, but in other cases, it was a prediction from the respondent based on how they expected non PV tenants would feel.

Another explanation of jealousy reported by participants were wider issues relating to perceptions of recent social and political events such as place transformation and an influx of new residents benefiting from the social and economic changes in the area. These perceptions were noted by Ali, age 29:

Well, I think that everybody should be entitled to it, but obviously, because of it being so expensive not everybody's going to get it. But um, I think that there might be a bit of a thing going on, why have they got them and not me? I do hear a lot of people saying oh, it's always Braunstone that get everything.

She also said:

Um, people from where I used to live, people there have been saying oh what are these things they're putting on the roofs, so a lot of people have obviously been reading things and heard about it. And people have been saying are you having it? And, I've been saying yeah. I've not got it yet but I am soon. And they're quite shocked by it, they're thinking eh? Why's it just Braunstone that's getting it? Why's it just on the 'Six Streets'? And I'm just like; well I'm not really sure. I think it's just like the first place that's gone to. So I said probably once they've done a trial here, see how it goes you know different areas may get it.

Other tenants similarly explained that they were aware that people living on other housing estates made remarks about how Braunstone receives lots of resources compared to other estates that have similar social problems:

P: If it does work, then I think people will be putting in complaints wanting the same thing won't they?

R: Do you reckon?

P: Yeah definitely, so if it does work=

R= people who haven't got it?

P: I don't think they're grumbling but a lot of people are wanting to know what's what with the 'Six Streets', coz of what they've [the 'Six Streets'] got and what's happening with their houses and stuff.

The above extracts suggest that people may want PV because of perceptions of changes to the social and physical structure of the area as a result of the influx of new residents and physical improvements to the area. This relates to the discussion in section 7.2.1 regarding community tensions resulting from transformation to the 'Six Streets'. These comments suggest that non PV tenants within the neighbourhood were unaware of why certain tenants were going to receive PV and others were not. It draws attention to the issue of how the PV panels were distributed amongst the 200 houses in the 'Six Streets' area, based on technical viability, but that this was not necessarily explained well to local tenants.

Manstead and Hewstone (1996 p342) explain that the term jealousy is commonly used to refer to envy, but that they need to be treated separately. Jealousy and envy are:

Related negative emotional states deriving from interpersonal situations often involving social comparison...the distinct nature of jealousy and envy must be realised; the two emotions are based upon different cognitive appraisals and motivate alternative behaviours.

“Jealousy is typically an aversive emotional experience characterised by feelings of anger, sadness, and fear, induced by the threat or actual loss of a relationship with another person to a real or imagined rival” (Ibid. p342). Whereas, envy is defined as “the begrudging of another’s possession of an attribute or relationship that one would like to have for oneself” (Ibid. p342). Envy is the more accurate psychological state involved in what participants noted non PV tenants supposedly feel. The quotations above suggest that non PV tenants may begrudge the fact that they have not got PV. ‘Social comparison’ is a term used within social psychology to refer to self-evaluations that are made on the basis of comparisons made with other people who are similar. It follows that envy is perhaps arising out of the fact that neighbourhood tenants perceive themselves as similar (which relates to Uzzell et al.’s (2002) concept of perceived homogeneity discussed in section 7.2.2) and therefore feel that they have missed out on having PV as suggested by Ali’s comment “why have they got them and not me?”

Another interesting point about the *in vivo* code of jealousy in the data is that some of the responses from tenants report that non PV tenants will be jealous based on (reported) evidence from direct communication with them. However, other residents suggest that residents will be jealous with no apparent evidence, but more based on evaluations of the social dynamics in the community.

This may be PV tenants also taking part in social comparison, and both of these types of responses (reported actual jealousy and reported projected jealousy), may be understood in light of psychological evaluations of self-esteem. Self-esteem is derived from

individual attributes, but it is also derived from how one perceives oneself in relation to one's social environment as set out in social identity theory (Tajfel and Turner, 1979).

Social identity theory posits that identification with a group of people who you share similarities with will enhance self-esteem if the group is compared more favourably with an outgroup. In this case, PV tenants (ingroup) are enhancing their self-esteem by distinguishing themselves from tenants who are not going to benefit from the solar PV systems (the outgroup). In other words, this suggests that PV has the potential of enhancing self-esteem for the residents who have it installed whilst at the same time, the PV being a point of differentiation within the community. The significance of this finding for undertaking a similar renewable energy social housing project is that efforts should be made to consider the effect to those benefiting from the renewable energy technology, but also to those who are not receiving it, as this could have potentially negative effects on community cohesion underpinned by inter-group psychology. This may be a particularly important issue if envy is a particularly salient issue for people on low incomes and is increasingly important as energy prices increase. This finding also suggests that the benefits of the community trust fund, that is, using the money saved to re invest in new projects for the local community, could have been better communicated more widely across the neighbourhood.

Bonaiuto et al., (2002) found that beliefs about economic resources were a factor affecting attitudes to imposed physical change to a region of Italy, across different groups of users. Social identity theory was used in this study to explain group differences.

Social-psychological theories of group behaviour are useful in understanding the concept of jealousy in this study. The study of individual PV tenants' was the object of study in this thesis, however, the social processes of interpersonal networks, social comparison and perceived homogeneity serve as a reminder that the 'self' is made up of interpersonal interactions and behaviours. These are the object of study within social psychology. These findings also support the suggestion that Uzzell et al.'s (2002)

conceptualisation of PRSI was a more useful theory to employ in this study than other place theories.

7.3.2 Distinctiveness

Related to how non PV tenants perceive PV and the concept of envy is a code that emerged of 'distinctiveness'. Positive attitudes towards PV were expressed by some residents who made a distinction between themselves and other people in the area who were not recipients of the PV. Residents suggested that they felt "chuffed" (Helen, aged 20), "special and lucky" (Elanor, aged 21) that they were having PV installed in their homes. By saying that they feel special, this suggests that respondents see themselves as part of the group who are getting panels, as compared to the rest of the neighbourhood who are not getting PV. Anita said:

P: So I'm one of the lucky ones to get it then ((giggles)).

R: How do you feel about that then?

P: ((Giggles)) I feel quite special.

Similarly, Ali, age 29 said:

I'm quite chuffed that I've got the opportunity to have it done coz I don't think everybody's having it done, it's only certain people, so yeah, I was quite happy that I'd been given the chance to have it done.

Twigger-Ross and Uzzell (1996) define distinctiveness as the desire to maintain personal distinctiveness or uniqueness and this usually occurs in order to see oneself in a positive light. These findings can also be understood in light of Rogers' (2003) suggestion that relative advantage of adopting an innovation can be seen in terms of conveying social prestige. "The degree of relative advantage is often expressed as economic profitability, as conveying social prestige, or in other ways" (Rogers, 2003 p299). The distinctiveness reported by the participants indicates a social as well as economic advantage. Other factors of perceived relative advantage of PV are discussed in Chapter 7.

Furthermore, these quotations also relate to self-esteem, another principle also suggested to govern identity. This is suggested to be a benefit of PV in the following quote by Elsie, age 28, who said:

Well, I've done lots of thinking about it, I just don't know, it's just the excitement of waiting for it to be done, I mean obviously the added bonus of free electricity, it makes you unique then, centre of attention, because everybody's going to ask, you know, oh how's it going, you know, what does it involve, stuff like that.

This social advantage is related to the fact that PV is mentioned as highly visible by many of the participants this finding also relates to Rogers' innovation characteristic of 'observability' and echoes Klein's (1983) finding that having a solar collector mounted on the roof led to questions and comments from other people and that the "flattering role of the advisor was willingly accepted" (Klein, 1983 p179).

If people say they feel special and lucky, are they really expressing gratitude, or are they talking up the status conferring effects of receiving PV panels? Where people discuss feeling lucky, it would seem that this could be related to the economic aspects. However, it is interesting that the PV is not seen just for its economic advantage, but that low-income tenants acknowledge the social advantages of the PV.

7.3.3 External homophilous communication

As well as mostly positive comments from friends and family, there was evidence of interest in solar PV from outside the 'Six Streets' from people who lived in other areas. For example, Elsie, age 28 said:

It looks boring but you get people walking past that stop or like people come down and admire them and say you've got solar panels, as in ooh, look at that. Do you know what I mean, they're noticeable. Um, that's nice.

Jose, age 22 said, “my relatives, and friends, they ask “what’s that there on the house”? I say the solar panel.”

According to Rogers (2003), observability stimulates discussion as people ask others how they evaluate the innovation in question. DIT is concerned with the communication of an innovation over time and interesting to note in a discussion of communication across social networks is that the perceived attribute of observability was actually termed ‘communicability’ by Rogers in his 1962 (first) edition of *Diffusion of Innovations*.

7.3.4 Observability

Related to whether or not people stopped and asked questions about the PV was how noticeable the PV panels were to PV tenants and non-PV tenants suggested in the quotations from Elsie and Jose above. There was disagreement amongst the sample as to whether the PV was easily visible across the small ‘Six Streets’ area. Some responses fell into the category easily visible, as suggested by Esme, age 19:

I didn’t really think much into it and I just, at first, when they started putting them up over next door, umm, I’m not sure, it looked weird to see these panels on the roof.

Also, Michael, age 24, similarly said, “I’m looking forward to it, yeah, cos I’ve seen them on other houses and thought they looked good.”

Visibility of PV to people inside and outside of the area is related to Rogers’ (2003) concept of ‘observability’. This is defined by Rogers (1971) as the degree to which the results of an innovation are visible to others. Participants commented on the visibility of solar PV within the ‘Six Streets’ area based on comments from others and on how they perceived visibility for themselves.

A number of participants said that PV was not that noticeable as suggested by the following quotation.

To be honest they're not that bad coz I went down Webster Road, they've got them on all ready. To be honest they don't stand out that much, I thought just like it was going to be some big panels and everything like this, they're actually quite in well with the roof so...

Another pattern emerged in the data however, suggesting that solar PV was not very visible. Responses suggesting they are hard to see link to the idea that PV is not as intrusive to the physical environment as other energy technologies. (Energy Saving's Trust, 2006.)

Barker and Riddington, (2003) suggest that PV is evaluated more positively in comparison to other renewable energy technologies, because it is deemed as quiet with no moving parts and unnoticeable. Participants' perceptions and evaluations of PV, relating to the category of observability, were in accordance with this argument as highlighted through the two excerpts above.

Visibility of PV changed over time and reflected the PV project delivery. Earlier on in the data collection period it was common amongst the first ten residents interviewed for them to say no to the question "Have you seen solar PV before?" However, once the solar PV project was underway, most people had spotted PV going on roofs and were able to answer 'yes' to the question. Interestingly, unfamiliarity with PV for one woman was exemplified in her not knowing whether she had seen a panel yet, because she did not know whether the one across the road was the finished product or not.

Both outsider perceptions and environmentally significant features are suggested by Uzzell et al. (2002) to aid the process of place identification. It follows from this, given both the section above on 'jealousy' and the nature of the category of visibility, that PV may aid place identification in two ways. Firstly, PV is an environmentally distinctive feature. Place identification seemingly exists for participants already given that there is a

distinct 'Six Streets' boundary (commonly referred to) in which the regeneration took place. Other environmentally distinctive features are mentioned throughout the interviews in PV tenants' evaluations of Braunstone (e.g. the new houses, new play park areas and the new health centre, outsider perception of the area both before and after the regeneration). PV is another physical aspect of the area that serves to add to place identification. Secondly, people have stopped to ask questions and outsiders' perception of an area is another factor suggested by Uzzell et al. (2002) to enhance place identification. It would appear that the PV is enabling PV tenants to share a place-related identification by their ingroup status that distinguishes them from non PV tenants.

7.3.5 Imagability

Evaluations of the aesthetics of the PV panels on the roofs of the houses in the area was an issue talked about within responses regarding visibility of the panels. Interpretation of aesthetic evaluations suggested that a function of PV may be to enhance the image of the area and that this may have both individual and collective benefits.

Image was an aspect of evaluations of PV in addition to the perceived attributes of an innovation as theorised by Rogers' (2003). In some cases, interviewees linked the appearance of the panels to physical regeneration of the 'Six Streets' area. The theme of 'image of the PV' captured comments on the value of the panels in enhancing the appearance of the area.

Three categories of aesthetic evaluation emerged. Some participants appeared unconcerned about the appearance of the panels such as Becky, age 19, "Not too bad, not an eyesore" and Fred, 81, who said "they look better than a big pylon outside your front garden."

A number of participants suggested a symbolic description of the PVs as a futuristic technological innovation. This second category of responses was called "hi-tech" (John)

and included descriptions of the PV as “shiny” (Tracy), “spacified” (Tracy) and “hi-tech” (John, age 42) as Tracy, age, 27 said:

R: What do you think of the appearance of the panels?

P: They're quite nice. You know they're not like a fashion accessory, but they don't look really ugly. They look quite spacified don't they? ... shiny at the bottom or they're lighting up.

These responses suggest that people envisage PV as something modern and something new and may be a factor in the visibility of the PV systems. In other words, the aesthetic qualities may mean that the panels are more noticeable. In this sense, although it is not conclusive within the data, some tentative conclusions can be made concerning the function of PV. This could be in terms of either collective benefit or personal benefits in terms of neighbourhood image and expression of personal identity.

However, it should be noted that although a number of respondents perceive the panels to be aesthetically pleasing, some people thought the PVs looked ugly. The appearance of the panels was felt to be a secondary consideration to the benefit of receiving panels.

Alan gives an example when he said, “I saw them down the street, the other side of the street and I was thinking they look quite ugly but if it's going to save money, I don't care.”

Claudia, age, 32 noted that her friends have remarked on the appearance

R: Ok. Fine. What do you think of the appearance of the panels?

P: Erm a couple of my friends have said that they are ugly, but er, to be honest with you, like my dog normally says, looks aren't everything you know.

7.3.6 Heterophilous networks and PV

A striking finding was that participants mentioned that their knowledge of PV and understanding of the project had come from the housing officer when they signed the contract for their homes. All of the participants except for the three mentioned in Chapter 6 who did not know about the project had spoken to the housing officer and she was crucial in participants' knowledge and conceptualisations of PV as shown in the following quotation in which the respondent was asked how they thought solar PV worked:

R: Right, how do you think they work?

P: Well I used to think it was just the sun ((giggles)).

R: Have you heard since that its like

P: Just daylight.

R: How do you know?

P: (XXXX) told me.

Dissemination of information to the residents via the housing officer reinforces the idea of the influence of social networks and there were many quotations across the transcripts illustrating that the housing officer was key in communicating information about the project generally, advice on energy generation and consumption and issues to do with project implementation.

Errol, age 31 said:

Well she said something about kilowatt eh, about how much it generates ...but she said kilowatts are what you use in the day right, but that you won't use that in the day.

Similarly, Harriet, age 30 said:

R: What do you think about having a solar panel on your house?

P: I think it's good.

R: Why?

P: Because the housing officer told me that it means free electricity in the day.

The finding that the housing officer was the person within the social network of the PV tenants responsible for providing tenants with information about the project can be related to Rogers' (2003) idea of a 'change agent'. Previous work within the DIT framework has demonstrated the importance of a change agent or a leader in a community who communicates the innovation to the community. This is a 'heterophilous' contact, who is dissimilar to the target community. Rogers' (2003) points out, however, that it helps if change agents are not too dissimilar to the target community in terms of socio-demographic variables such as age and education. This would suggest that the decision to use the housing officer as the change agent was a good idea given that the housing officer was a young, female who was approachable, and well connected with the area, as this had more potential for success in persuading the PV tenants to adopt PV.

The housing officer was viewed by the 'Six Streets' tenants as the person to go to for residents to sort out individual problems within their homes. Uzzell et al. (2002) discuss the concept of a social reference point in their study of how social and place dynamics affect attitudes towards sustainability. The housing officer can be considered as a shared social reference point. Understood in this light, it is perhaps not surprising that she was also the main source of contact for imparting all the information and issues about the solar PV. Understanding the place dynamics and context further deepens our understanding of the responses to PV.

7.3.7 Misinformation/misconception

Related to information exchange regarding the PV project, it was evident from residents' evaluations and perceptions of the PV systems that some had formed misconceptions about the panels. Notably, residents asked if a red and green traffic light system was fitted at the same time as the panel inside the house. This referred to a green light indicating when free electricity was available for use. Also residents commonly asked if

a switch activated the solar panel. In some cases it was explained that this idea had come from the housing officer, or the PV installers. Other comments suggested that the information had come from rumour and hearsay across the community. Another common misconception was that electricity throughout the day would be completely free.

Jo, age, 19:

Erm, I've been told that the electricity during the day will be free, and then you just pay for your night times.

7.3.8 Perception of the change agent

Rogers (2003) suggests that the change agent needs to be credible, competent and trustworthy. This suggests that perceptions of the change agent, or the change agency involved in promoting the new innovation (in this case the PV), may provide an insight into perceptions of the PV and the PV project.

Most typically, respondents did not know which organisations were behind the project, but BCA (the neighbourhood renewal organisation that was managing the New Deal for Communities funding) was talked about in relation to the regeneration work in the area and the political infighting that took place within its committee. It also emerged that some participants had family or friends in the BCA and had gained some information about the project that way. Other organisations in the project were mentioned also, but they were not talked about at great length.

Overall, LHA as an organisation was viewed positively, but there were negative comments about the time the organisation took to respond to requests to fix problems in people's homes.

Regarding the nature of the communication that had come from LHA, two tenants such as John, age 42 below, suggested that LHA did not fully know what was occurring during the delivery of the project and suggested that this is why they themselves did not know anything about the project.

I mean they're not too bad, I mean they're very informative Leicester Housing, but they've not really said anything about the solar panels apart from we're having em and that's it. I don't think they actually know what's going on, when the scaffold's down, what the PV are going to do.

7.4 Summary

Uzzell et al. (2002) found in their study that 'social relations largely revolve around family and friends in both neighbourhoods'. This chapter describes the nature and extent of social networks in Braunstone following descriptions from residents of social dynamics within the 'Six Streets' area and Braunstone more widely. It shows that tenants' descriptions suggest that there is strong social cohesion amongst the tenants, but that some older tenants think that the newcomers have eroded the social cohesion. Both old and new tenants expressed that community tensions exist within the area as a result of the 'New Deal' funding. These findings suggest that social dynamics have changed in the area.

Only a tentative link could be made between family, friend and peer networks and attitudes to PV. Where PV residents had discussed PV with others, the responses fell into four main groups: a) peers were disinterested; b) peers were excited; c) peers were envious as they wanted PV installed in their homes; and d) a minority of participants said their friends made negative comments or were sceptical. Overall, the data suggests that peers are not particularly important in influencing PV tenants' perceptions and attitudes towards PV despite a strong homophilious network existing.

There seemed to be little support for the idea that homophily influenced people's attitudes and perceptions of PV, but it was the case that communication from the

housing officer influenced attitudes to PV. In some cases, this led to misconceptions about aspects of the PV project. Tenants in the PV homes have friends or relatives or neighbours that are jealous of them having PV. This was explained as being related to the perceived financial benefit. It was reported to be because of the Braunstone area receiving 'New Deal' status.

The status conferring aspect of PV in that it made PV tenants feel unique was a reason for positive attitudes to PV.

Visibility of the PV panels was interconnected with interpersonal communication about PV as the PV invited comments from other people and there was disagreement as to how visible the PV panels are on the roofs. This is related to another attribute-perception of 'image'. Responses to appearance of the panels varied according to whether residents' evaluations related to the aesthetic value of the panels, such as whether residents found the panels ugly or beautiful, or whether more symbolic evaluations were made, such as when the panels were referred to as "hi-tech" (John, age 42). The majority of the residents evaluated the panels as fine to look at, with the minority describing them as ugly.

8 Findings: Technology Diffusion

8.1 Introduction

Rogers (2003) suggests that the process of diffusion of an innovation is a type of communication involving new ideas. Although the housing officer appeared to be the main communication source from which the majority of PV tenants gained knowledge about the project, it emerged that PV was so new in Braunstone that a small number of participants either did not know, or had forgotten that they were having solar PV installed on their roof. This revealed a theme of 'lack of awareness' of PV and the project. Sub-themes under the main theme of 'lack of awareness' will be discussed below.

8.2 Lack of awareness of PV

A number of inter-related themes explain why some of the participants said they could not respond when asked the question, 'how do you feel about having solar PV on your house?' Lack of awareness was illustrated by three participants who had no strong feelings towards the PV reporting that they had not been told about the project until the researcher was introduced to them. Fred, age 81, when asked if he had told anyone about the PV project said: "No, this is the first time that it's been mentioned to me".

Eleanor, age 21, similarly said "I just saw them putting them up and I thought, I wonder if we're gonna get them. And that was the last thing. And then you ring a couple of days later." Eleanor also said that she did not know much about the project and a report of a conversation she had with her neighbour also illustrates that her neighbour did not know she was having solar PV either.

I only really know that they're being put on these houses along here and that some have gone up in Webster Road. I spoke to the lady next door about them and she was saying that they didn't

know anything about the panels, they hadn't even signed the agreement and they just put up the scaffolding and off they went.

Alan, age 26, explained that he had not heard anything about having PV panels since being told by the housing officer that he was having them:

I've not heard anything about it since but I've seen them going up and when you rang me, that's when I heard about it again.

It was common in the interviews for participants to say that they knew very little about the project other than that it was happening, as illustrated by the following exchange with Ali, age 29:

R: What do you know about the solar panel project?

P: Not a lot. All I know is that I've been offered them and they're going up and once they're up they're up.

Also, Sheila, age 23 said, "If I knew more about it I'd probably be able to give you an opinion, but I don't really know."

Lack of awareness of the project was apparent across the interviews and in some cases the participant thought that the purpose of the research interview was for them to learn more about the PV project. Sally, age 33 suggested that this was why she agreed to participate in the interview:

R: What do you think about having a solar photovoltaic panel on your house?

P: Um, it will be different, I don't know much about it, so that's why I said you could come along and I'd find out what it's all about.

Some participants thought that this was why the researcher had come to see them, to tell them about the project.

R: Do you know much about the solar panel project? The actual project?

P: Na, that's another thing I'm not familiar with, that's why you're here, I take it?

In asking people the broad question 'what do you think about having PV installed on your house?' the interviews captured statements and opinions of first becoming aware of solar PV. This is what Rogers assumes is the 'knowledge' stage of the 'innovation decision process'.

Given that the PV was new, it appeared from responses that there was a range in how much residents had thought about the PV and subsequently how much they talked about PV. Overall, awareness of the PV project was varied and participants' comments were correspondingly complex. Often residents similar to Fred, Eleanor and Sally above, simply communicated that they could not respond to the researcher's questions, because they did not know anything about the PV. This was further indicated by some of the narrative being characterised by 'turn taking' whereby participants gave very short answers.

8.2.1 Indifference

For the rest of the participants that were aware of the PV project, there was variation in how much people knew about it and had consequently thought about it. This was also reflected in how much people talked about the PV and the PV project during the interviews. For example, the question, 'how do you feel about having PV?' in many cases, elicited one word, or short answers such as "I think its ok", "I'm alright about it", "I don't really know a lot about it", (Emma, aged 21) whereas other respondents talked at greater length about their perceptions of and feelings towards PV.

Fred, when asked how he felt about having solar panels said, "I don't know how I feel. I've never thought about it" and gave quite short responses to interview questions. However, John, age 42, in contrast to Fred, talked at length about his beliefs about the PV and accordingly said, "we have thought it through; we just can't wait to get it up there."

Whereas Fred, Elanor and Sally apparently gave short answers simply because they could not respond in anymore detail, in other cases, short answers suggested a sense of indifference from the respondent. Fran, age 21, provides an example:

R: How do you feel about having solar panels on your house?

P: Alright.

R: What do you think it will be like?

P: I don't think it will make much difference to me.

Deborah, age 22 expressed indifference by saying, "I don't know much about them, they're stuck on your roof, that's it, if there's any problems you have with them, I'm sure I'll find out."

Slightly different expressions of indifference were found in the data when residents said that they did not think the panels would affect them because they cannot see the panels as they are out of site on the roof, such as Emma, age 21:

I don't think it will make much difference to me. My neighbours will be able to look at it but I won't. I think it will be alright.

Related to this issue is observability of the PV panels for the participants, i.e. how noticeable the panels and their effects are to the tenants. Quotations related to this issue were presented in Chapter 7 under 'visibility of PV'.

Expression of indifference towards the PV panels and the PV project was generally made by younger tenants, such as Fran (age 21), Deborah (age 22) and Emma (age 21) above suggesting an age related difference in how much participants appeared to engage with the PV. It is also the case that Fred, age 81 expressed indifference towards the PV so no firm conclusion can be drawn, but it is noteworthy that this pattern of young females expressing indifference is different to the 1970s studies which suggested that

solar adopters were typically younger. Possible reasons for no strong feelings towards the PV are a lack of interest in the PV project, lack of self-efficacy in the long-term effects of the project. Residents may perceive that financial relative advantage of PV outweighs any problems. Also, as argued in Chapter 7, energy is not something that people usually have to think or make decisions about.

8.2.2 Indecision

Although step three of Rogers' (2003) innovation decision process (the decision to adopt) had already been made on behalf of the participants, a feature of the PV project was that tenants had a choice over whether they would have a PV panel installed or not. Of the tenants who were having PV, three told the researcher that they were undecided as to whether to have the PV installed despite having said yes. This is illustrated by Sally's boyfriend, Tony, at the end of their interview when he said "I mean, it's her decision at the end of the day. If she don't want it and she feels as though she's not comfortable, then she won't have it."

Interestingly, three households declined having a PV system installed on their roof at the outset of the PV project (two of these were existing council tenants). For the tenants who said yes to having PV, the above responses show some control being exercised over the 'authority decision' being made by the project institutions to implement the PV project. The responses suggest that the uncertainty over whether to have PV or not was related to feeling like they were accepting a new innovation that they did not know a lot about. In relating these individuals to Rogers' innovation decision process, these individuals could be described as being at the persuasion stage.

Similar to Sally above, Alan, age 26 who was interviewed with his girlfriend could not form an evaluation of PV and was also undecided as to whether or not to have PV:

R: What do you think about having solar in your house?

P: I don't really know much about them...so I'd like to know more before I say yes, and before I say no to be honest, that's what-

His partner Sarah, age 20 continues later with, “I mean the house over the road have got them going up, so we’re quite keen aren’t we”. In the interview Sarah went on to express a more positive evaluation of PV. “I’m a bit excited because it’s sort of new, we’re going to be the only ones having it ((chuckles)). No it’ll be good I think it will. Everyone we’ve spoken to said GO FOR IT!”

Wisenbilt (1981) discusses the ‘social risk’ involved in adopting solar technology and Klein (1983) notes that having a new technology could be embarrassing if it does not work, because it is highly visible, but that these anxieties are alleviated if people perceive that they are not alone in installing solar technology. This appears to also be an issue affecting Alan and his girlfriend Sarah in the findings above, whereby the uncertainty involved in the decision process of having the PV is in some way eased by seeing that others in the ‘Six Streets’ area are having panels too.

It was also mentioned in four other responses such as from Elanor (age 18) and Annie, (age 31):

My next door neighbour would look just as silly if it looks silly ((laughs)).

And we’re not the only ones that are having it done, if it was just us I’d be a bit nervous but some roads have had them done already haven’t they?

It appears from the comments between Alan and Sarah above that this couple were forming their attitude towards PV during the interview. This quotation is a good example of a feature of many of the interviews whereby participants either presented a range of conflicting comments about having PV on their house, or formed their opinion as the interview was being conducted. This highlights a methodological concern of how best to understand the perspective of the participant and raises the issue that attitudes are not necessarily stable, but that people make up their minds depending on the situation they are in. On this topic, Miller and Glassner (2004) suggest that what people say in

interviews is selected, situated and partial. Similarly, Bickerstaff & Walker (2002) suggest that what people say in interviews cannot be assumed to give direct access to experience, “what we see in people’s talk is not just recalled experience but also an active search for meaning.” (Ibid. p2180). The following comment by Fran suggests that she was still forming her opinion on what solar PV means to her whilst being interviewed, and perhaps points to the issue of opinions coming into mind when people are asked to think about them, rather than tapping into beliefs and meanings that are already fixed.

I didn’t feel that I could say well hold on you know, these kind of things are triggering into my mind now, they weren’t triggering into my mind when I was speaking to (XXXX) [the housing officer].

8.2.3 Summary

This selection of quotations illustrates that the solar PV was so new in Braunstone that residents who were having it in some cases did not know about it. Due to this lack of awareness and exposure to the PV systems and the project more generally, many of the participants spoken to could not form an attitude towards the project nor had any apparent strong feelings towards it. This led to sub themes interrelated to the main theme of lack of awareness, that is, sense of indifference or lack of interest towards the PV project. Also, relevant to this is the methodological concern of how attitudes are unstable. It is also the case that evaluations were not compartmentalised but often a number of evaluations were made in the same response that were often contradictory as in the example of an excerpt from Sarah above.

8.2.4 Lack of consultation

Related to 'lack of awareness' of the PV project (conveyed in the data presented in Chapter 6) is that the theme of 'lack of consultation' emerged when participants said that they had not received any information about the installation process and the project more generally.

For example, John age, 42 said:

I'm quite looking forward to it but we're, it was coming in December, then it was January, then February and now we're into March and you think well hang on a minute we're getting a bit fed up with it now, is it coming or isn't it coming?

Andrea, age 22, expressed both positive and negative evaluations of the PV project. On being asked how she felt about the installation process however, she said "er...having the work done...crap! Being woke up at 7 in the morning with them banging away, without even notifying me that they are going to do it at that time in the morning."

She went on to say, "hopefully it will be beneficial, but they've not even informed us about when we're gonna get power from it or anything...and all I'm saying is it would be nice to be notified."

Several other residents were irritated by the inconvenience that had been caused to them by the installation process and said that it was not practical for them to be repeatedly waiting for workmen to arrive at their house.

Surprisingly, although people said that they didn't know much about the project, only a handful complained about the lack of consultation. Amanda, age 39, expressed positive evaluations of the PV, but negative evaluations towards the PV project more generally. In discussing her negative perception towards the way the PV project was conveyed to the 'Six Streets' residents, she expressed a stronger view on the issue of 'lack of

consultation' she had received suggesting that residents had not been informed of the PV project details in an appropriate or respectful way:

I mean, personally, I think the whole way this thing's happened, it's really lax, you don't get informed of anything...but it doesn't seem right. It's like they just don't know ((pause)) it's either they think that you don't need to know what's happening or they're not prepared to tell you, I don't know, it just doesn't seem right. They just expect you to know what's going on...or haven't I got any interest in it or don't they care if I've got any interest in it? Do you know what I mean?"

Several interviewees mentioned that they were surprised that a leaflet or booklet had not been sent to them to explain the PV. Amanda, like Andrea, was also annoyed by the inconvenience of not having a more precise time for visits to the house for installation of the PV system equipment. "Well, I'd have liked some sort of list of when people are coming and when, and you know, who are coming and also some information on how it works and I don't know, some little booklet or something."

One interesting finding was that one participant was actually a community worker, Tracy, age 27 who knew Braunstone very well. She was very positive about the project, but she also had a lot of advice on how the project could have been better delivered. Similar to Andrea and Amanda above, themes of lack of information and consultation were apparent in her interview:

I don't know I think it would have been nice to have been given a choice and be like told everything from the outset. You know instead of just coming and saying look, this is what we're going to do. Can you sign this? ((pause)). This is what's going to take place, this is going to go up, and we'll have to do that and that.

Furthermore, she claimed that a number of people in Braunstone had reading difficulties or would find a leaflet unmanageable and that they therefore needed a person to knock on the door and take the time to go through a leaflet with them. Her assertion, that

people would be unable to read a leaflet, contrasts with the quotes above that suggest that people wanted such information. However, this finding is interesting in light of literature on community development which suggests the importance of local knowledge in the process of introducing new ideas (Gilchrist, 2004). Also, this echoes Rogers (2003) suggestion that an innovation will be adopted more easily from a change agent who has a good knowledge of the target community. In her interview, the community worker Tracy also discussed how the right kind of information provision could mean that the rest of the community across Braunstone might want solar PV also. Regarding what people need to know about the PV project, she said:

This [the PV] is what they are, this is what they're going to do and these are the benefits and obviously people are going to gain a lot more knowledge and then who knows, the city council residents might worry and go to the city and say look, we want these on our roofs. These people are getting these benefits and we want these benefits as well. Or it could work both ways couldn't it? We don't want those...rubbish.

Eleanor said something similar about the diffusion of the PV across the community:

Well I think if, I don't know, I don't think um, I think if it's a good idea, I think more people are going to want to try it, have it tried out with them as well, and um, and it's whether you can get it spread round Braunstone quick enough. But if it's not a good idea and they want more to happen anyway then there's going to be arguments over that anyway isn't there?

Rogers and Shoemaker (1971 p12) suggests that "diffusion is a special type of communication" about a new idea, and these comments echo the theory of the flow of communication within DIT that lead to the eventual uptake or rejection of a innovation.

8.2.5 Lack of information

As PV was new in Braunstone, participants used the interviews to try and form an understanding of how the PV works and to make sense of the installation process and how their house would be affected. Lack of information affected the perceived benefits of the project. It was common for residents to ask questions of the researcher concerning what the panels would mean for them. This resulted in interviewees asking the researcher the questions the interview schedule planned to probe such as ‘How does it work?’ ‘How will it benefit me?’ ‘How much will I save?’ Jane asked who is behind the project; “Um, it’s pretty good really, I don’t even know who’s brought it and why they decided to. I mean do you know why?”

Three themes emerged from the questions asked about the PV project; compatibility, reliability and complexity. Firstly, nearly all participants put forward views or posed questions regarding compatibility of PV with their electric system. Concerns about compatibility were at times expressed in terms of how the PVs would work with the existing electricity system, whether or not PV is safe, or, the inconvenience (‘hassle’) of having PV put in the loft.

As well as repairs and insurance matters, John listed other concerns about the compatibility of PV with his electricity system and this was a common concern. The following excerpt sums up his ambivalent attitude towards the PV:

We want to try it out. To see what’s going to happen to it. How’s it going to work? How does it marry up with our electric? What does it mean, does it mean that during the day the solar power is going to take over. Or is it that it’s going to run intertwined with the electricity, what’s going to happen with it and no one has actually given us a booklet on solar power is quite amazing.

Safety was a concern for Ali, age 29 and her concern hinted at trust in institutions:

I don't know if it can affect you in any way. No one's ever really said anything. A lot of times, people don't say anything and then when things go wrong that's when it all comes out, so I've thought about that.

Reliability referred to comments and questions with regard to the functioning of the PV systems, for example, whether the PV technology would actually work and mistrust in UK weather conditions to provide enough sunlight.

It was common for participants to ask questions relating to all three categories. For example, Sally, age 33 appeared anxious about having PV and said that this was because she did not know enough about it and asked "Um, well, exactly how do you go about putting it in? Um, What exactly am I going to benefit from it? What does it do? How does it work?"

John, age 42 mentioned the most concerns about how the PV might work and had seemingly thought about it in detail. He had considered whether his house could catch on fire, whether his house would be colder because the slates had been replaced with PV tiles, whether he would have to come back home at night particularly to switch from the PV to his mains electricity system, what would happen if the system failed, what would happen if it was vandalised and he was very worried about costs and insurance. Some of his concerns are apparent in the following excerpt:

Where's the repairs coming from? If someone puts a stone through a solar panel who's going to come and repair it? How does it stack up, do we put it on house insurance. Ow does it work? What if my house goes up in flames because of the heat coming through the solar panels? Are they liable for it, am I liable for it?

Similar to John, Deborah, age 22, had concerns about how much electricity the system will actually generate and these concerns echoes Wisenbilt's (1981) concept of functional risk which is risk associated with the running of the panel and its efficiency:

P: Yeah I'd like to see if they are actually any good you know? Coz, you know, you see people with them and that, but never you know they've got one on their house to actually generate to use the electricity

R: When you say good, you mean good at generating

P: To see if they actually do generate a lot, yeah.

Other issues related to functional risk were that several residents were under the impression that a switch needed to be pressed to turn the PV system on and benefit from electricity generated from the PV panel.

Several tenants had concerns regarding what would happen if they were to finish their tenancy. For example, Sarah asked whether she would be charged because they signed the contract in agreement of having the PV panels:

You know, I don't know if I'm under contract, am I going to have to have it for 12 months or something, you know like you do your Sky or whatever? I don't know who's paying for the solar panels, and whether if I leave I'm breaking a contract and I'll end up having to pay for them or?"

Other concerns from tenants were about maintenance and what would happen if they had wanted to buy their house. Also, there was some degree of uncertainty around beliefs about the transparency of electricity companies. Another concern was "what happens when I go on holiday" (Amanda, age 39).

Ali, age 29, who thought the solar PV was "a good idea" perhaps best sums up the degree of risk and uncertainty involved that Rogers (2003) describes is inherent in the decision to adopt an innovation. She said:

What if I hated it and just didn't get on with it, coz you don't know these things do you, do you know what I mean, you just don't get on with it and I'm not going to get on with it ever, what if I did?

Interestingly, two households from Zimbabwe had previous experience of living with solar PV. Similar to other participants, questions about PV concerned whether there is enough sun in the UK for the solar PV to work and whether the PV will work efficiently. Both also asked whether the panels will work if it is snowing, as did another resident who was from Leicester. George from Zimbabwe said:

They [the PV] store energy and give it out. They store it from the sun. Do you know what will happen if like, they're on top of the roof and snow comes over it? Will it be able to store energy?

He went on to say:

It could be coz I mean for example like in this country yeah, the temperature here is cold. I think the solar panels are better off in places like in Africa where I mean most time. Where here with a lot of snow coming down, then you've rain here and there, I think it could be a problem. It all depends on the model. If the solar panels that you are supplying now are more advanced then maybe it would not be a problem but it could be a problem.

Taken together, these findings relate to the theme of lack of awareness and can be understood in light of Rogers' (2002) discussion of the innovation decision process. Rogers (2003) suggests that the first stage of the process an individual seeks to know what the innovation is, how and why it works. Moreover, he suggests that the questions that people typically ask of an innovation are; What is it? How does it work? Why does it work? What are the innovations consequences? What are its advantages and disadvantages? These questions are similar to the questions asked by participants in the interviews.

8.2.6 Trialability

The interviews revealed that because a small number of the 'Six Streets' residents felt that they wanted to know more about the benefits of PV and how it worked, they visited an environmental show home, approximately one kilometre from the 'Six Streets', in order to gain information about the PV panels. 'Trialability' was used as code in the

transcripts where instances of people going to the show home for information emerged. Although this does not directly relate to residents' trialling the PV systems, Wisenbilt (1981) discusses the concept of trialability and suggests that demonstration show rooms have a rôle in enabling potential adopters to ask questions about solar systems.

Additionally, a number of participants mentioned the 'Ecohouse' when asked if they had seen a PV panel before. Murrell (2000) also argues that demonstration show homes can aid awareness-raising about renewable energy. The discovery that some residents went to the 'Ecohouse' to learn more about PV systems lends weight to this suggestion. This category is linked to the issue of heterophilous social networks, a key characteristic implicated in communication of information of PV and discussed in section 7.3.6.

8.2.7 PV as an experiment/volitional control

Warwick (2001) reported that Peabody tenants reported "feeling like guinea pigs" when asked their perceptions of a proposed PV project. Related to this, the perception of the PV as a "trial" (Ali, aged 29) or "experiment" (Noreen, aged 22) in this study was mentioned by six residents, which in one case was apparently exacerbated by having a university study carried out to monitor the PV project. This suggests that the process of taking part in the study influenced the perception of the project for one resident. This phenomenon within social science is known as the 'hawthorn effect' (Shaugnessy and Zachmeister, 1997) which describes the situation where a study or experiment has the effect of changing the behaviour or performance of the participant because they are aware they are in a study. The principle of self-efficacy was suggested in chapter two to explain the phrase "feeling like guinea pigs" within the Warwick (Ibid.) study because this principle relates to perceived loss of control over a situation. However, any loss of perceived self-efficacy suggested in the transcripts in this study was not deemed to be a threat, instead the three residents just presumed they were taking part in a trial without appearing particularly bothered about this. Residents were very matter-of-fact in apparently seeing the project as being for the institutions in charge and seemingly thinking that if the trial worked, then other institutions would invest in solar PV.

8.3 Relative advantage

Despite a number of residents apparently having no strong feelings towards the panels, the data indicates that overall residents viewed the installation of PV on their roofs optimistically. Most commonly, positive attitudes were expressed towards the solar PV panels amongst the majority of the participants with differences in how emphatically positive remarks were made. Positive evaluations were therefore complex. A number of variables were apparent that explained residents' positive evaluations of PV.

8.3.1 Socio-economic benefit

Firstly, financial benefits were identified as the most common reason for positive evaluations.

Jane, age 21, was one of the few residents to have a solar PV panel already installed by the time of the interview and she said:

I think it's a brilliant idea. Mine isn't running yet, it's not working yet, but I'm hoping it's going to bring down the electricity bill. It should do. It's supposed to save a lot of energy isn't it?

Harry, age 30, said this also. "I think it's a good idea. It will cut the cost of electricity yeah. So that would be a good idea. If there are no more costs to be included then..."

Harry's comment, "if there are no more costs to be included" is an example of remarks from other participants that suggested that saving money is generally important to them. It also indicates uncertainty expressed amongst the residents about the outcomes and process of having the PV installed (discussed in section 8.2.4).

Positive evaluations of PV due to financial relative advantage were often presented alongside concerns about other aspects of the PV panels. Often participants thought it

would save them money, but that there might be other problems such as Eleanor, age 21, and Noreen, age 22, respectively below:

No, I think um, I think...if I've got any problems, I always make sure I've got contact numbers and I'm the first to make a complaint if I'm not happy but, I'm confident about it because it's got to save you something hasn't it. Do you know what I mean?

Well, if it, if it saves me money I mean I'm all for it at the end of the day, but it's just the hassle of why putting them up and that...Cos I've seen em, they're doing the ones on the corner at the minute, and it just seems like that scaffoldings been there forever, and I mean it's only a few tiles, innit really?

Alan, age 26, seemed pleased that PV would save him money even though he did not like the appearance of the PV panels or whether they would save him money:

I seen down the street, the other side of the street and I was thinking they look quite ugly, but if it's going to save me money, I don't care. I don't know how it works, well obviously you need the sun I presume.

Similarly, the aesthetic value was secondary to economic saving similarly for Anita, age 24, said:

P: I think it's brilliant. If it helps me save some money on my electric bills. They don't look very pretty ((giggles)).

R: Right.

P: But, I suppose as long as it's saving money...

It is possible to interpret these findings, on financial benefit, in light of the attribute 'relative advantage' from Rogers' (2003) attribute-perception model. Relative advantage can be in economic terms and for residents in Braunstone the above quotations relate to the potential saving to be made in economic terms. It is well to note here that relative advantage does not have to be objective advantage but perceived advantage. This finding

corresponds with data suggesting that financial challenges run through the findings. For example, budgeting was talked about in the context of purchasing environmental goods (i.e. participants said that they choose budgeting over whether or not a product is environmentally friendly) and buying goods for settling into their new homes, e.g. carpets. Furthermore, saving energy in the home (discussed in Chapter 6) and the concept of envy (discussed in Chapter 7) was related to economic circumstances of the tenants. It is perhaps not surprising that any economic saving is likely to be greeted with a positive evaluation. The analysis showed diversity in strength of participants' responses expressing a positive attitude towards PV.

Despite the majority of participants believing that their bills would be reduced, some people saw disadvantage to having the PVs.

Five participants said that they believed that their bills would go up. However, four of these participants also said that they may save money. This type of response illustrates the complex nature of qualitative data that runs throughout the findings. In some cases this was because people felt that their bills were very low already and in others this was because they were expecting their new tariff to be more expensive as illustrated by Sarah, age 35, "I'm not quite sure what the rate of electricity is for when I use the electricity at night, I mean it could be double what I'm paying now so I'm not getting any better out of it."

John, age 42, expected his bills to be higher too:

R: How do you think it will affect your bills then?

P: Well I personally think it will go up. If they're changing the meter, I think it'll go up coz I don't think the technology's there at the moment to drive it forward even further, I really don't...

The above excerpt from John suggests that he does not perceive that the technology is sophisticated enough yet to bring down his bills. This is similar to comments by PV

professionals suggesting that PV is not economically viable because of lack of efficiency (Keirstead, 2007). John also said that he should save money based on what he has been told about the PV project.

Responses from 43 households relating to whether people thought that their bills would go up or down can be summarised as 35 households said they expected their bills would go down, one thought they would go up, four said both up and down.

8.3.2 Behavioural response

There was evidence in the data that suggested that PV *may* impact on people's behaviour once the PV systems are working. In discussing how he thinks his bills will go up, John mentions that he will monitor his bills once the PV is working. A number of residents commented that they would make sure they use as much electricity in the day as possible, or do their washing in the day such as Anita, age 24, in the following exchange:

P: We'll I'll be extra careful not to use it so much ((giggles))

R: OK.

P: Or else I'll get them big bills ((giggles)).

Elisha, age 23, also suggests that she will try and use her appliances in the day:

P: No, no coz, hopefully if I'm here all day, I'll get it all, things like that done during the day so I'll use the energy whilst it's there.

Jane age 32, implied that although she was not expecting considerable reductions in her electricity bill, that this was irrelevant to her because of the other perceived financial and environmental benefits of having PV:

I'm very excited about it, I think it's great, ((pause)) I mean, I'm not here in the day, so I'll benefit it at the weekends, but I don't care. I do think it's really good that you've got environmental issues aswell, I think it's good that we are doing something. I think it's good that I'll be able to take advantage of it as well.

Jane later went on to say that she would get timer switches fitted so that she could benefit in the day. This also indicates a behavioural response to installation of PV panels.

Importantly, in contrast to Jane who stated that she works but that she would benefit at the weekend, a small number of residents mentioned that they felt that the installation of PV was a good thing because many tenants across the neighbourhood were single mothers who were at home during the day. This relates to Stokoe's (2005) notion of 'normative social order'. This refers to participants identifying the social context in the neighbourhood and social categorisation of themselves. Tenants suggested that they would benefit because they were unemployed and would therefore be benefiting from the maximum output from the PV, due to residing at home during the day. This highlights the idea of behavioural responses to PV as discussed by Klein (1983) in thinking about when and how the energy produced by the PV will be used. This can be illustrated by the following comment from Lucy, age 23:

R: What do you feel about it?

P: Um, I don't know, I know it's obviously for saving energy and things but it's a really practical idea for people like me who are not working and who live on their own, so they're in the day and so they're actually going to use it and make use of it, so I think it's quite a good idea.

Similarly, Anita said:

I think it's a good idea...especially, for people like, people like me. On income support, cos like Emma said, it was mainly for people who can't afford the bills and that, so I think it's a good idea for that to save some money.

The phrase “people like me” shows that interviewees express perceived homogeneity in the neighbourhood in their responses to the positive impacts of PV. Participants were categorising themselves according to attributes such as unemployed, single, at home during the day. This self categorisation may be understood in light of social identity theory which would suggest that residents are expressing a common social identity with people who are deemed to be similar. Social identity theory defines the self in terms of memberships of groups. This can be related to Uzzell et al’s. (2002) concept of perceived homogeneity discussed in section 7.2.2 in Chapter 6.

Anita’s comment also suggests that the notion that PV is a good idea came from the housing officer (as was discussed in more detail in Chapter 6, section 6.3) and perhaps is evidence that the change agent is imparting the practical aspects of the project to the residents in such a way that the decision will be accepted.

The PV systems will export any electricity that is not used to the centralised electricity grid whether or not tenants are at home during the day. This was mentioned by participants very rarely.

8.3.3 Summary

Relative advantage in terms of economic saving was a theme running through the interviews. The nature of the data relating to this varied depending on how positive people were in their other evaluations of the PV systems.

A notable number of people expressed that their bills might go up and three different reasons were given for this; a) because they would not benefit from the PV because they would be at work during the day; b) their bills are perceived to be very low anyway; and, c) lack of confidence in the PV systems to make a difference in terms of energy generation.

There was evidence from one participant suggesting that his bill had in fact reduced since the PV system on his house had been commissioned.

8.4 Collective relative advantage

8.4.1 The community trust fund

The importance of benefiting economically from the PV was expressed in terms of the PV being good for the community, as well as personal (individual) financial benefit. Expected beneficial social effects on the community were also expressed by participants. Most typically this occurred in conversation about the community trust fund towards the end of the interview, when participants were told by the researcher what the community trust fund was, if they were not already aware. Awareness and knowledge of this aspect of the project was limited with many of the participants not aware that revenue from any excess electricity sold to the grid would be placed in a community fund and used across the neighbourhood. However, 26 participants said that they thought the PV project would be beneficial, for the community as well as for individuals. Other participants simply did not acknowledge any wider economic or social benefits and, in a minority of cases, some participants saw the project as a “money making exercise” (e.g. Charles, age, 23) for the project institutions. Discussion about the trust fund also led to residents talking negatively about how ‘New Deal’ money had been spent in Braunstone and therefore their expectation was that the trust fund would not be beneficial. However, participants such as Donna, age, 35 below did see the benefits for the neighbourhood:

I think it's quite exciting because it's new and I'm going to be able to test it and hopefully benefit from it. I think that in the long run it improves the community aspect as well because it's up there and it's going to be doing its job and other people are going to be benefiting and you know it's the environmental issues as well isn't there so yeah, I think that's good.

Prakash, age 22, said he thought the trust fund was good. Interestingly he appeared to have more ‘self’ motivations than selfless motivations for why he thought it was good.

He saw the PV as beneficial because it draws attention to him. He said “NO I think that’s good, because people are going to say, I’m helping them.” This comment appears to refer to the status conferring aspects, aside from the perceived economic advantage of the PV. In contrast, all the other participants who spoke about the trust fund in a positive light, had altruistic motivations and saw a clear need for money to be spent on improving the area.

8.4.2 Physical environmental benefits

As well as the collective socioeconomic benefit, the benefit to the environment in terms of physical transformation was considered by 13 households. Furthermore, benefits associated with electricity saving were seen as helping the environment on a global scale.

8.4.2.1 Local environment

Some residents thought that PV would improve the image of their house or their street or Braunstone as a whole. This example from Elsie, age 28, illustrates that she perceives the PV as good for the reputation and image of the area:

I mean I think it’s good for the area because there’s a lot of buzz about it, as soon as you say you’re on the six streets then everyone’s like ooh, you know, are the houses nice? And everybody seems quite excited about you know, it’s the council and the HA are trying to uplift the image and the reputation which is brilliant, but on a personal point of view I’m excited because I’ve never done something like this before and that’s a big thing of helping, that’s not just me recycling and turning lights on and stuff, that’s even more.

Pauline, age 26, also commented on the role of PV in improving the physical environment:

R: How do you think that will affect Braunstone more generally?

P: [I think it’s better]

P2: [It’s to do it up, more and more people] because at the minute, no one wants to move to Braunstone, because it’s rough.

In some cases, participants said that PV would be better for the community and it was not always clear whether this was better physically, or socially as illustrated by the following quote:

Just that in the day I won't be paying so I think that's great. I think it's good as well. The impression that I'm under is that everything that's not used is put back in for the community which I think's great. (Claudia, age 32)

8.4.3 Global environment

Collective relative advantage was also expressed in terms of the PV panels being a means to address global environmental problems.

Elsie above described her excitement with respect to helping the environment as well as the project being good for the reputation of the area. This is also illustrated by Jane who said, "I do think it's really good that you've environmental issues is really good as well, that we are doing something. I think it's good that we are doing something,"

Gail, age 32, who spoke a lot about global environmental issues in her interview and apparently believed that the PV was a good idea because of the need to develop new methods of generating electricity:

Well I mean, um, it's well it will reduce our electric bills plus any extra is going to be sent to the national grid, if there is anything over, um, and I mean, there needs to be other ways of generating electricity other than what um we've got at the moment.

She also mentioned the benefit to the community via the trust fund:

Um, no, I don't have any concerns. Um, I think it's a good idea. The LHA can put that money back into whatever the community needs, I mean that can only be better can't it.

Interestingly, George, who had lived with solar panels and learnt about them through trade shows in Zimbabwe said a lot about the link between PV and wider environmental issues. George was very positive about the PV project and saw solar panels as a common sense practical solution to environmental problems caused by burning fossil fuels. He was very negative about other forms of energy generation:

Burning coal leads to carbon emissions. The dams for hydroelectricity. For them to be constructed takes a lot of space. The environment surrounding it, the whole ecosystem around that is changed.

George and Gail talked more coherently about the link between PV and the environment than other participants whose satisfaction and awareness that PV would help the environment did not lead to much discussion beyond a recognition that PV is linked to the environment in some way. The issue of PV being good for the global environment was mentioned by 16 participants. Comparatively more talked about the benefit to the community. For both George and Gail, their past experiences were an explanation for why they knew so much about environmental issues. Gail explained that her dad brought her up to have an interest in environmental issues and in addition to George saying “I studied a little about solar panels” and that his knowledge came from school, and media. “Well I keep myself informed, uh we watch lots of TV. Just recently I watched some flick about the environment, (‘The Day After Tomorrow’).” It was the case that for participants who had more environmental awareness, that this had also come from work related activities, or community activities.

Interestingly, two participants when talking about global warming said if it gets hotter, then they will save more money because the solar PV will generate more electricity. They therefore saw a different kind of beneficial link between PV and global warming:

I'd love it if it got warm, the solar panels would work better then. (Pauline, age 26).

Despite global environmental problems not being a predominant feature of perceived benefits to having solar PV there was nevertheless evidence of concern of wider environmental problems across the sample. Responses highlighted a variety of levels of environmental awareness and concern.

8.5 Chapter summary

There was variation across the interviews in terms of how much participants knew about the PV project, had thought about PV and about how they thought it would work. Some people said that they did not know anything and there was a range of understanding of how PV was expected to work once installed. In addition, there was some concern over the installation and operation. Related to this was a perception of lack of information mentioned by a number of residents. These findings highlighted that many questions were asked about the benefits and consequences of PV because the PV is perceived by the residents as an innovation.

Tenants on the whole were seemingly not that bothered by lack of awareness. It just seemed to be a factor in people not having a lot to say about the PV. This relates to indifference. Lack of information was deemed to be a problem if this affected daily routine (e.g. scaffolding going up during the installation of the PV).

This chapter suggests that some participants' responses expressed 'indifference' towards the solar PV project. Lack of awareness was found to relate to indifference, indecision, uncertainty, contradiction.

Perceptions of and attitudes towards the innovation arising from an authority type of decision such as 'indifference' or negative evaluations resulting from 'lack of information' That residents' responses to PV expressed concerns and many questions regarding how the solar PV functions and the benefits they will experience suggests that overall residents think having PV is positive, but that there is insufficient awareness and understanding of how PV functions and how it will affect their homes. Five tenants went

to the environmental demonstration show home in order to learn more about the impact of the PV project.

It can be seen that a range of affective responses was reported when residents were asked how they feel about having a solar PV panel on their home and that some people in Braunstone have apparently thought about having solar panels more than others. Many residents were excited about having panels and underpinning these positive feelings is Rogers' (2003) concept of economic relative advantage. The economic relative advantage was the reason most participants gave as to why a change from a pre-payment to a credit meter was not perceived to be a problem. The data also illustrates that relative advantage of PV is perceived at different levels. As summed up by Jane, not only is she individually going to benefit from it, but that there's the "community aspect" and "the environmental issue as well".

Interestingly for the 2 residents from Zimbabwe who had had experience of PV, their answers did not differ dramatically from the rest of the sample in respect to knowledge and awareness of the project and PV. It was the case, particularly from one participant, that language made it difficult for some questions to be understood. However, though this needs to be taken into account, the types of responses were generally very similar with the interviewees merely recounting their experience of solar PV in their home country. In contrast, when responding to questions concerning environmental issues, one of the participants appeared to demonstrate a more coherent understanding of the environmental agenda.

Uncertainty of the PV systems was to do with how compatible the PV was with the house and electricity systems. Reliability, safety, and how much mess would be made in the house were other concerns. Compared to 1970s literature, concerns were linked to disruption of daily functioning and convenience. Also tenants did not know how they work.

This chapter suggests that attitudes and perceptions are still forming because the theme of 'lack of awareness' of PV emerged, which corresponded to the theme of 'lack of information'. Other data that supports this assertion is that some people were still making up their minds as to whether or not to have PV. Findings suggest that there were no differences between men and women in the type of questions asked about the PV project.

9 Study 2 Results

9.1 Introduction

This chapter presents results from the questionnaire survey carried out in the second phase of the research. This survey was carried out three years after the pre-installation interviews. It would have been ideal to repeat the first study in order to provide a better comparison of how individual attitudes of and perceptions towards PV changed over time, however this was not possible due to time constraints. Instead, it was decided that a small-scale questionnaire would be administered at the case-study site. As Robson (2002, p236) points out, “interviews involve an interviewer for the whole time; in a face to face situation travel can add very substantially to the time and cost involved”. Questionnaires, by contrast, are often less demanding of researcher time.

Although the questionnaire was the best form of data collection due to time constraints, this choice of instrument imposes some limitations. Firstly, as Robson says, “self-completion questionnaires can be subject to response bias; for example people with reading and/or writing difficulties are less likely to respond” (Robson, 2002 p236). This was a particular consideration given the socio-demographic profile of participants in this research.

A limitation of this survey was that only 50 people were approached to participate and of these 50, only 13 responded (26%). This was too small a sample to use inferential statistics when analysing the survey data. Analysis was restricted to identifying trends from descriptive statistics.

Despite the limitations, it was deemed important to: 1) capture information on people’s experience of living with the PV systems; 2) see whether attitudes towards and perceptions of PV had changed over time; and 3) follow up some themes that emerged from study 1. The questionnaire was designed with these objectives in mind, using findings from study 1 as a basis.

The results presented build on those from the pre-installation interviews. Therefore the survey results are comparable with the themes that emerged from the data in Chapters 7-9. As in the interview study, quotations accompanying the results are presented using pseudonyms.

9.2 Results

9.2.1 Socio-demographics

Five out of thirteen survey respondents were also interviewed in study 1 and eight were not. As explained in Chapter 5, five out of 50 houses surveyed were new build houses built after the main study was carried out. In addition, some tenants interviewed at the pre-installation phase had moved out of their home. Of the people who responded to the questionnaire survey, eight were female and five were male. The age profile of respondents is shown in Table 9.1. The table shows that the age profile differs slightly for the profile in study 1, in that the majority of respondents are slightly older.

Table 9.1 Age profile of respondents

<u>Age range</u>	<u>Number of respondents</u>
18-24	2
25-30	5
31-35	0
36-45	2
46-60	3
Over 60	1

9.2.2 Information

Questions one to four of the questionnaire asked about the information people had received about the PV.

The questionnaire responses were largely consistent with the findings from study 1 in that 11 respondents wrote that they first learned they were receiving a solar PV system from the local housing officer. Of the other two respondents, one stated that the solar system was already in place when they moved in, and the other that they were notified by letter. These information sources are summarised in Table 9.2.

Table 9.2 Source of information that the tenant was having PV

<u>Source</u>	<u>Number of respondents</u>
Friend	0
Neighbour	0
Housing Officer	11
Other	2

In study 1, a theme emerged of lack of information. To further explore this, questions were asked about the dissemination of information on the project in the questionnaire. Two respondents wrote that they were very satisfied with the information they had been given. Four were quite satisfied. Five were not satisfied and two could not say. Therefore, satisfaction was expressed by six respondents, compared to seven who were either not satisfied or could not say. These responses are summarised in Table 9.3.

Table 9.3 Level of satisfaction with information received

<u>Level of satisfaction</u>	<u>Number of respondents</u>
Very satisfied	0
Quite satisfied	6
Not satisfied	6
Could not say	1

Related to information provision, only three of 13 respondents reported that they knew enough about the PV. Nobody wrote that they knew “a lot”. Eight respondents wrote that they knew “a little” and two that they new nothing. Therefore, ten respondents wrote that they know less than enough about their PV system. This relates to another finding; that six respondents wrote that no-one had explained the PV system to them. All

of these six also wrote that they either knew “nothing” or “a little”. The level of information residents said they had is shown in Table 9.4.

Table 9.4 Level of knowledge the PV project.

<u>Level of information</u>	<u>Number of respondents</u>
A lot	0
Enough	3
A little	8
Nothing	2

Taken as a whole, these findings suggest that residents did not feel that they had received enough information about the PV system to develop a satisfactory level of knowledge. It also seemed congruent with study 1 that the housing officer was the key source of information about the systems.

9.2.3 Satisfaction

Questions five to seven asked about satisfaction with the PV system. Overall satisfaction ratings are shown in Table 9.5.

Table 9.5 Level of satisfaction with PV system

<u>Satisfaction</u>	<u>Number of respondents</u>
Very satisfied	0
Quite satisfied	6
Not satisfied	6
Could not say	1

No respondent wrote they were very satisfied, but six wrote they were quite satisfied and a further six that they were not satisfied. One person did not answer this question. Of those who expressed dissatisfaction, Janice wrote the following: “I would get rid of it because I don't see any benefit. I pay the same amount of electric as if I did not have solar panels”. Respondents who wrote that they were not satisfied reported that this was to do with not having any saving on their electricity bill, with the functioning of the panel, and with having to switch to a pre-payment electricity meter. One person who

was reportedly quite satisfied also wrote that they had not seen any decrease in their bills. Aspects of the PV system that respondents reportedly liked are shown in Table 9.6.

Table 9.6 Aspects of PV systems that respondents reportedly liked

<u>Aspect</u>	<u>Number of respondents</u>
Saves money	0
It's good for the environment	7
Environment and Look	2
Nothing	4

Nine of the 13 respondents wrote that they liked their panel because it is good for the environment. Two of these nine also wrote that they liked the look of their panel, and four wrote that they liked nothing about it. Of these four, two gave further comments. For instance, Janice wrote “It's a joke. I was led to believe I would save money. Not at all. Someone saves money but it isn't me”. Greig wrote, “They have added money to the rent yet have never worked and never got any help when checked.”

When asked if there was anything that people disliked there were 6 negative responses. These included Chantelle who wrote, “the look of them” and Kelly who wrote, “the quarterly bills”. Greig wrote, “we feel stuck with the supplier and our bills for day energy are very expensive when it should be free”. Janice appeared to be incensed saying that she disliked “the thought of people making money on my solar panels when I still pay £7 a week. Just like I didn't have them”.

Overall for satisfaction, responses were split. Just under half of the respondents were quite satisfied. Of those who expressed dissatisfaction, the reasons given were, similar to those expressed by Greig and Janice above, to do with not saving money as a result of having PV.

In study 1, tenants discussed inconvenience of the PV installation process. When asked in this study whether they were satisfied with the work done to the system, four of 13 replied “yes”, five replied “no” and four replied that they “don't know”.

9.2.4 Complexity

Given that in the first study the theme of complexity emerged when tenants discussed their concerns surrounding how the PV systems would work, tenants were asked about this in study 2. Table 9.7 shows responses to the question “Is your solar electric system easy to use to use?”

Table 9.7 Perceived ease of use

<u>Easy to use</u>	<u>Number of respondents</u>
Don't know	9
Yes	3
No	1

Three people wrote that their system was “easy to use”, one wrote it was “not easy” and nine people wrote “Don’t know”, which may suggest that people did not have a clear understanding of how their PV systems worked. Consistent with the findings reported in section 9.2.2, this suggests a general lack of knowledge about the systems.

9.2.5 Perceived economic relative advantage

All respondents replied that they had believed at the beginning of the PV scheme that their electricity bills would go down. This supports much of the interview data whereby respondents evaluated PV favourably because of perceived relative advantage of the PV systems in terms of economic advantage from a reduction in their electricity bills. However, when reporting whether their bills had actually changed, only three out of 13 replied that their bills had gone down. Six reported that their bills had gone up, three did not know and one replied that there had been no change. Of all the respondents, only three stated that they knew how much money the solar PV system had saved them (or not saved them). For example Kevin wrote that he had saved “nothing at all and with the sun we have had I can't understand why it ain't cheaper”. John wrote “it has not saved us anything” and Greig stated “NONE!” Malcolm wrote, “£30”. Reported savings are summarised in Table 9.8.

Table 9.8 Perceived reduction in electricity bills

<u>Perceived reduction</u>	<u>Number of respondents</u>
Yes	3
No	6
Don't know	3
No change	1

The respondents were asked whether or not any problems had occurred with Ecotricity, the electricity supplier. This question provoked some interesting responses related to problems with billing and the service provided. These included Anne who stated that she “didn't get a bill for 10 months then they wanted it all at once and it is expensive”. Greig stated, “we had no bill for a year although endless phone calls to them then bill was £700 and goes up £100 every three months!” Veronica response was “why my bills were so high when I have solar panels” and Fred stated that he “had a bill for over £100 - I am over 84 I could not pay that amount at one time. I used to have a meter card but they now send me a bill”. Clare also stated a problem with payment by stating “v. high prices for electric bills, £180 per quarter, I think is very expensive”. John replied that Ecotricity “never read the meters”. All except one of the 13 respondents had reportedly stayed with Ecotricity.

Table 9.9 shows respondents' answers concerning the importance of knowing how much electricity was generated by their PV panels. Only one replied that this was not important and one did not answer this question.

Table 9.9 Importance of seeing how much electricity the PV system generates

<u>Important</u>	<u>Number of respondents</u>
Yes	11
No	1
Did not answer	1

9.2.6 Energy consumption behaviour

Responses suggested that no steps had been taken to alter behaviour in respect to energy used in the home, except for two people who suggested that their bills had gone up and therefore they needed to try and conserve energy to counter this. Greig stated, “yes - we are trying to use less because expensive and cannot manage bill!” Clare answered, “Yes, using eco-kettle, turning off lights, turning washing machine to 30°, recycling waste”. John replied no because, “it makes no difference the cost has spiralled out of control”. Seven people replied they had not taken any steps to save energy and four did not answer this question.

9.2.7 Image of PV

In study 1 (pre-installation), a number of residents commented that PV would improve the image of the area. Some people replied that it would make their house look better and some replied that it would make no difference to their house. In this study (post-installation), ten respondents replied that it had made no difference to the appearance of their house and nine wrote that it made no difference to appearance of Braunstone. Three people replied that it had improved the appearance of house and four that it had improved the appearance of Braunstone. Notably, no respondent said that the PV panels had made either their house or Braunstone as a whole appear worse. Table 9.10 shows respondents’ answers concerning the impact of PV on the appearance of the houses and Table 9.11 shows the impact of the PV on Braunstone.

Table 9.10 PV impact on appearance of house

<u>Impact</u>	<u>Image</u>
Enhanced it	3
Made it worse	0
Made no difference	10

Table 9.11 PV impact on appearance of Braunstone

<u>Impact</u>	<u>Number of respondents</u>
Enhanced it	4
Made it worse	0
Made no difference	9

9.2.8 Communication of PV

Following the study 1 finding that PV tenants talked to others about the PV panels (albeit a limited amount), questions regarding communication about the PV were asked in study 2. Where PV tenants spoke to non PV tenants about the project, Table 9.12 shows where non PV tenants were living when the communication occurred. Most conversations about PV were between people that lived on the ‘Six streets’ or across Braunstone. Discussion with other non PV tenants occurred outside of Braunstone.

Table 9.12 Communication with others

<u>Where person lived</u>	<u>Number of responses</u>
Six Streets	5
Braunstone	2
Outside	4
Did not respond	2

Table 9.13 shows that when discussion about the PV project occurred, comments from five people about the panels were negative, whilst four people made positive remarks. Two people replied that they hadn’t spoken to anyone and two respondents did not answer.

Table 9.13 Communication with non PV residents

<u>Non PV tenant remarks about PV</u>	<u>Number of responses</u>
Positive	4
Negative	5
No comment	2
Did not respond	2

Interestingly two of the more positive comments suggested that non PV tenants would like PV panels. One person was reported to have said “that if they save the environment and cut electric bills everyone in Braunstone and City should have them.” Another person was reported to have said “the panels will bring down your bills and you'll save some money in this area. You are so lucky.”

More negative comments related to the lack of financial savings, with people reported to have said that the PV is “expensive” and to have asked “why are the electricity bills still the same?”

9.2.9 Understanding of electricity source

In study 1, only one person replied “solar panel” when asked “where does the electricity you use in your house come from?” Table 9.14 shows the responses to this question when asked in the questionnaire more than three years later. A box was left for respondents to write their answer, so it was an open-ended question. Three respondents did not answer the, three replied that they were unsure, and one apparently misunderstood the question and wrote “our living room and children’s bedroom”. Interestingly, four people replied that the sun or the PV and Malcolm, who stated PV, wrote “what I am sure is, part of that energy comes from the panels.” John answered “grid” and Janice wrote “the people that supply my electric.”

Table 9.14 Understanding of electricity source

<u>Where electricity comes from</u>	<u>Number of responses</u>
Did not respond	3
Unsure	3
Seemed to misunderstand question	1
Sun	3
PV	1
The grid	1
Utility	1

9.2.10 Environmental concern

To explore environmental awareness amongst the PV tenants, questions 41 to 43 of the questionnaire asked about how important local and global environmental issues were to them. Eleven people stated that local environmental issues were quite or very important. Ten people stated that global environmental issues were quite or very important.

Most people responded “no” when asked if having solar PV changed their level of environmental concern. Qualitative responses to whether solar PV changed their feelings about environmental concern were quite interesting. Clare answered “yes” and stated that “if everyone changes things only a little then it will change planet a lot” and Katie wrote, “I am more aware of how much electric me and my family use and how to reduce usage.” Malcolm also answered “yes” and stated, “because the source of energy is natural, the sun.” John answered “yes” but negatively stated, “don't try and save money with solar power it costs too much.” Greig answered “no” and wrote “I'm sure if we noticed positive change it would.”

9.2.11 Place attachment and resident satisfaction

Nine respondents had lived in Braunstone prior to moving to the ‘Six Streets’. Nine respondents had lived in their current homes for three years or more, so most have been resident in Braunstone for a substantial time. Half of these tenants were also very satisfied with living in Braunstone (whilst the other half were satisfied). Therefore, all respondents replied that they were satisfied with living in Braunstone. Eight tenants also

replied that that they intend to remain in Braunstone. Clare who was planning to leave the area replied, "would love to stay, to but have 2 bedroom house and have 2 children male and female". Chantelle replied, "I love the house" and Katie answered, "work in Braunstone and my 2 children go the local schools, have lots of friends here, enjoy living in Braunstone". Malcolm answered, "the house I am living in belongs to LHA. They don't sell their properties. I do hope I'll get the house I claimed from the City Council".

9.2.12 Any other comments

At the end of the questionnaire there was a box labelled "Any other comments". The comments made often pointed to respondents' apparent desire for more information about the PV panels and the scheme as a whole. Seven people left the box blank, but out of six comments, five suggested that residents were dissatisfied with their system in some way. Bills were a common concern, as the comments below illustrate.

Kevin wrote:

"Yes, I think for the time the panels was not working for two years, that we should be reimbursed with some of the bills we have had. It was not our fault that they was not put on properly but for the last year since they was working the bills don't seem to change at all. I just wonder if this is just a big con. I would like you to look at my bills and tell me different."

Greig wrote:

"We have reported the issues and no help from anyone. Our supplier refuses our meter reading and our usage is over £100 every 3 months. We work and are hardly home yet solar power gives us bills of this amount - we are very disappointed we feel that we had high expectations and are worse off now."

John wrote:

“Solar power should provide some sort of cost cutting, my bills have gone up and up, we use electricity to power the panels, the wiring is wrong, and I believe that all have been wired wrong, Due to the fact that none of the installers had done it before. The first time it was wired the wrong way round and therefore costing the tenant to run.”

Janice wrote: “I would like someone to get in touch with me and talk through how the panels work and how I can benefit from them more.”

Clare wrote: “I would like to receive more info on how to read meter to check the electric and power generated. Would also like to know why the bills have not reduced when installer told me my bills would reduce considerably.”

The only positive comment was as follows.

“I think the installation of panels is a brilliant idea. Many people amongst those who visited me think it is unfair, if not unjust that panels have been installed in Braunstone only. The panels help people save money, and it is a big step towards the global change, to stop global warming.”

9.2.13 Discussion

In interpreting all results from study 2, it needs to be kept in mind that the sample size was small and that not all respondents were interviewed in study 1 making a direct comparison between attitudes and perceptions at the different time stages difficult. It is also the case that respondents may not have answered very honestly or have taken filling the questionnaire out very seriously.

Another reason that validity may be compromised in this study is because it could be that the people who were motivated to respond were a biased subset of the PV tenants who viewed the PV negatively. In other words, it may be that people who were unhappy with their system were more inclined to respond to the questionnaire, while those who

were satisfied were less motivated to do so. These issues are suggested to be a limitation of this kind of research as suggested by Robson (2002).

Whilst recognising these limitations to this study, the findings suggest that residents required more information about the PV project in order to feel satisfied that they knew enough about the scheme generally and had an understanding of how their systems worked and were generating. This finding relates to the theme that emerged in study 1 of “lack of awareness” of the PV project and uncertainty regarding how the PV system would work.

At the same time, the results do suggest an increase in awareness of other energy issues compared to study 1, such as recognition of PV as a source of electricity. Reports of environmental concern in questionnaire responses also contrast with the apparent lack of concern in the study 1 interview data.

The questionnaire study supports the study 1 finding that communication about PV did occur within a social network that was spatially connected and highly interconnected and that the main source of information about PV was the local housing officer (change agent). In Rogers’ DIT (2003), the change agent is said to influence the rate of adoption and findings presented in this thesis are consistent with this idea (although, as explained in Chapter 2, adoption of PV was involuntary in the Six Streets).

The results all relate to the themes that emerged from the data collected in the pre-installation study. Results also echo Burningham and Thrush’s (2001) study, which suggests that low-income tenants have a strong sense of place and that they have a strong sense of local concern for environmental issues. This research suggests that equally, low income tenants have a high level of concern for global environmental issues.

The results suggest that people did not experience reduced bills as was expected in the pre-installation interviews and that this was a major source of dissatisfaction with the PV

panels. There may be a number of reasons for this. Firstly, the PV panels are relatively small in terms of peak output (1kW peak). Secondly, tenants are also not benefiting economically from export or storage of any excess electricity generated by the PV systems. Savings would almost certainly have been less if the respondents in the study were typically out during the day when the PV system is generating and when they could have been benefiting the most from the PV system. Furthermore, respondents may have had a poor understanding of their bills prior to PV installation or may have forgotten what those bills amounted to. Comparison of electricity costs is difficult because the majority of the tenants in both studies had moved house just before the PV project started and also because tenants had a prepayment meter. A further confounding factor is that electricity prices for consumers rose considerably during the period in which the project took place. For example, Powergen (who bought the East Midland's regional electricity company in 1998) raised its prices by 62.1% between 2003 and 2006 (Energywatch, 2006).

It is interesting to note that one respondent who expressed satisfaction with their PV system also stated that their bills had not decreased. Moreover, three residents did say that they had saved money on their electricity bills. Three respondents in the study did not know whether their bills had changed, which suggests that there could be difficulty in understanding whether bills had reduced and that clearer billing information is needed.

Overall the results suggest that the PV project was not successful in reducing bills and that it did not bring the personal financial benefits that many tenants expected at the outset. The implication of this is that if a similar project is to be undertaken in a social housing context, it may well be necessary to provide information on billing, supporting technical information, and information about wider changes in energy markets that would impact on bills.

10 General Discussion

10.1 Introduction

The previous four chapters have presented the findings and results from studies one and two. This chapter provides an overall discussion of the findings and how they relate to the literature reviewed in Chapters 1-3. Theoretical implications of social housing tenants' experience of PV are outlined using the two theories put forward in Chapters 2-4. Suggestions are put forward regarding future research in this field and recommendations are made for the implementation of renewable community projects in a similar context.

10.2 Study background and rationale

This thesis has investigated attitudes towards and perceptions of a neighbourhood renewable energy project in order to understand factors affecting implementation and uptake of such schemes amongst low-income tenants in a UK social housing context. As outlined in Chapter 1, there is a need for uptake of renewable energy technologies in urban neighbourhood settings if UK government targets for reducing carbon dioxide emissions by 60% by 2050 are to be met (DERFA, 2006). Solar PV panels were installed on 50 homes in the Braunstone area of Leicester, UK, providing an alternative to electricity generation from carbon-emitting fossil fuels. Furthermore, it was shown in Chapters 1 and 2 that researchers have emphasised the need for a better understanding of interactions between users of sustainable energy technologies and technology itself, beyond that of the rational consumer model of adoption (e.g. Devine-Wright, 2005; Roy, Caird and Potter, 2007; Shove et al., 1998; Strang, 1997).

Chapter 2 showed that research on attitudes to solar technology was carried out in the 1970s and amongst active solar adopters with a different socio-demographic profile to the solar adopters who took part in this research (as shown in Chapter 6). Chapter 3 showed that some contemporary research has looked at social and psychological aspects

of RET adoption, but both Chapters 2 and 3 suggest that more systematic research is needed in a UK social housing context. Chapter 2 argued that theorists have not investigated authority decisions, where the decision to adopt RETs has been made on behalf of the technology recipients. Chapter 1 also showed that contemporary research has tended to look at social-psychological aspects of renewable energy technologies from a “citizen-led perspective” (Devine-Wright, 2005). In contrast this research investigates a case-study site where an authoritative decision to adopt renewable energy has been made.

Two theories were used to understand the factors affecting social housing tenants’ attitudes towards and perceptions of PV. DIT (Rogers, 2003) was used because it was found to explain attitudes to solar technology in the 1970s. PRSI theory was used because it encompasses a number of psychological constructs from other place theories reviewed in Chapter 4 and because it has been used to explain pro-environmental attitudes and behaviours in an urban UK setting. In addition, Uzzell et al.’s (2002) theory looks at how physical aspects of place may affect attitudes to PV.

The first study investigated attitudes towards and perceptions of solar PV in the Six Streets area prior to implementation of the PV project, using interviews. Template analysis of 42 transcripts using a priori constructs from DIT and place-related identity theory was employed to analyse the data. The findings from this study were presented in Chapter 6-9. Study 2 sought to see whether attitudes and perceptions had changed three years after the PV project was implemented and further explored some of the findings in study 1.

Interviews were analysed to see how PV was evaluated and to understand what factors affected evaluations. The aim was to see how applicable Rogers’ (2003) attribute-perception model was as a framework through which social housing tenants’ perceptions and attitudes toward PV could be evaluated. Another aim was to see whether aspects of individuals’ social and physical environments, affected attitudes towards and perceptions of PV. A further goal was to see whether PV affected individuals’

perceptions of their social and physical environments. PRSI theory was used as a framework to evaluate whether there was a relationship between PV and perceptions of place.

Factors influencing attitudes toward and perceptions of PV were found to reflect constructs from both theories, and conceptual links could be made between the two theories. The data also revealed other factors that affected attitudes and perceptions towards PV that did not relate to constructs from the two theories.

10.3 Factors affecting attitudes towards and perceptions of PV

Perceptions of and attitudes towards PV panels amongst social housing tenants in this study varied across individuals. Perceptions and attitudes were related to characteristics of the PV systems, as well as to perceptions of the physical and social place. In study 1, although the majority of tenants evaluated PV favourably, there was a tension between this and a lack of awareness of the PV project. The reticence of some PV tenants in expressing attitudes and perceptions, as well as the combination of positive and negative attitudes when they were expressed, can be linked to both the newness of the concept of PV, related to which is Rogers' concept of uncertainty, and the stage of the project (pre-installation of panels).

DIT was a useful theoretical framework for understanding the implementation of a new technology in a neighbourhood. It was expected that it might be useful for understanding social networks and individual perceptions and attitudes, but it was also useful for understanding other aspects of implementation of the PV project at the pre installation phase (i.e. innovation decision processes and uncertainty are identified as issues in Rogers' (2003). As such this psychological component of the theory can be added to a conceptual model of adoption of PV in social housing.

Within the DIT framework (Rogers, 2003), five perceptions of attributes of innovations are assumed to influence adoption. Bauer's (1960) concept of risk was also invoked for

this study. These concepts are useful for understanding both the components of participants' responses to the PV project and the effect of the project across the community. Further, DIT suggests that characteristics (attributes) of an innovation and the 'social system' might influence attitudes towards a new innovation. The findings in this thesis suggest that this is the case.

Data reflecting the theme 'lack of information' (on the impacts and outcomes of PV) correspond to perceptions of PV in terms of Rogers' (2003) concepts of compatibility and perceived complexity. Uncertainty also relates to the concept of 'risk', which was found to be part of the attribute-perception model in previous studies, and all categories of risk as defined by Guagnano (1986) and Wisenbilt (1981) (i.e. economic, social and functional) were evident in participants' accounts of PV. This was apparent when participants said their bills might go up (economic risk), there may be embarrassment if the solar PV looked "silly" (social risk) and concern about how well the PV systems would work (functional risk). These concerns, amongst others that arose in the data reflecting uncertainty about the project presented in Chapter 8 are shown in Figure 10.1.

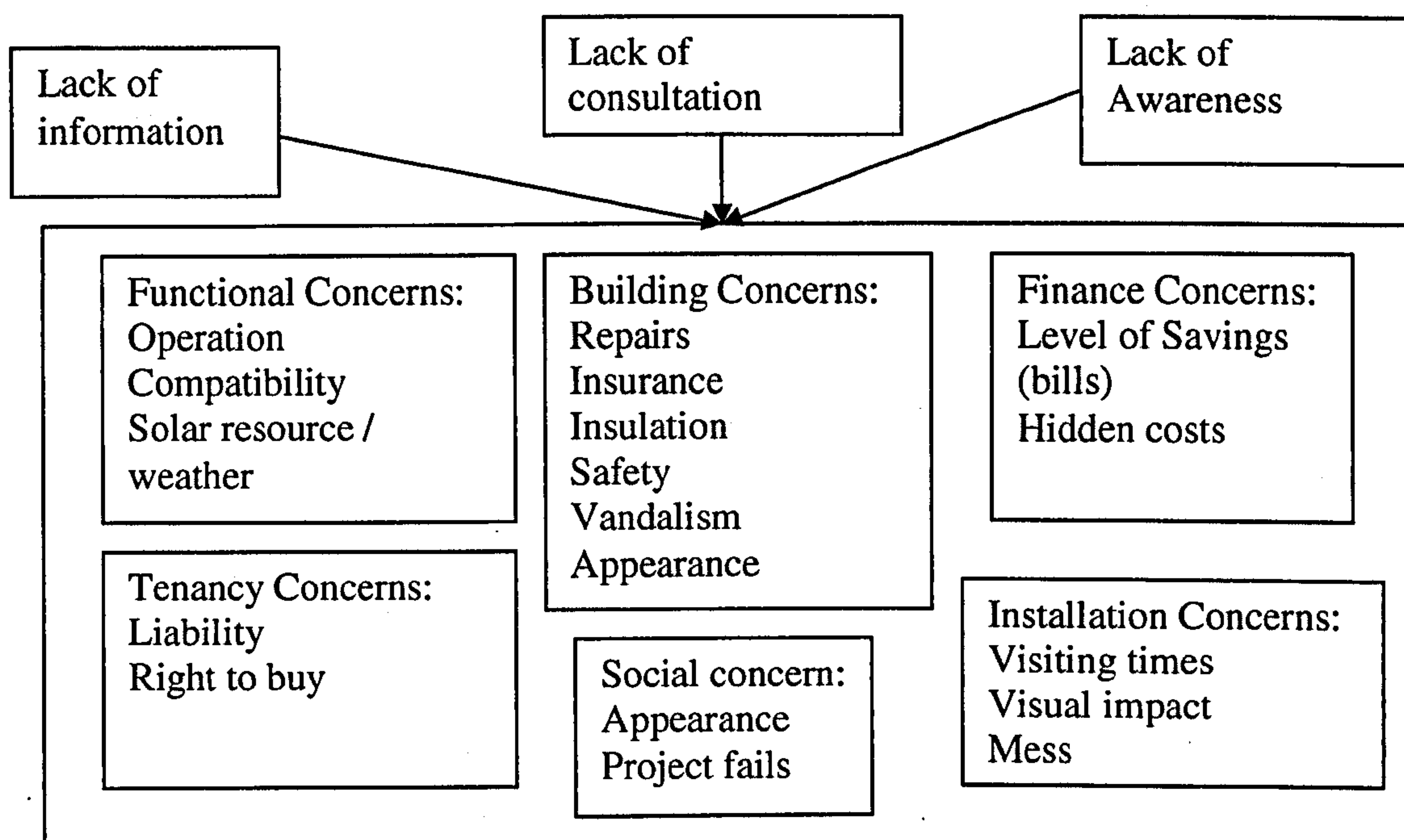


Figure 10.1 Perceptions of PV that relate to compatability, complexity and risk

The figure shows that the attribute-perceptions of compatibility, complexity and risk were related to the themes 'lack of awareness' and 'lack of information'. Some of these concerns are similar to PV tenant concerns in Warwick's (2001) study, discussed in Chapter 3. Study 2 found that tenants' bills did go up (economic risk), but a number of reasons for this that were unrelated to the PV systems were suggested (e.g. rises in UK fuel prices).

It is feasible that perceived risk is different for participants in this research compared to typical adopters in the 1970s studies, who had made the individual decision to adopt solar PV. This is because the residents were not subject to the risk associated with financial investment in PV technology. For example, the risks highlighted by Sawyer and Wirtshafter (1985) were economic risks and reliability issues. Residents in this research did raise economic and reliability concerns, but the risks were of a different nature (i.e. the economic risk was seen in terms of energy bills rather than payback

periods. Therefore, the type of adoption decision (i.e. authority) has impacted on how the project has been received.

The 'compatibility' component of Rogers' (2003) attribute-perception model was further supported by data on understanding of energy issues in Chapter 5. This revealed that there was a lack of understanding of how changing to a new utility and new electricity meter would affect energy procurement.

The theme of 'trialability' was found to be closely related to the theme of 'uncertainty' in this research. Trialability did not emerge as a characteristic of tenants' own PV systems, but the concept was invoked to describe the situation where tenants went to a local environmental demonstration show home for information on PV panels. This finding therefore supports Wisenbilt (1981) and Murrall's (2000) suggestion that environmental show homes are an aid to trialability for solar technology.

A key aspect of an innovation is that it presents a new idea to the receivers. When understanding communication of the new idea, this can be broken down into awareness of the new idea and persuasion to adopt it. Innovations researchers have found that a new idea may be best promoted by mass media, whereas persuasion may be best achieved through interpersonal contact with a respected change agent (Rogers, 2003).

This research suggests that a strategy is needed to better inform tenants in social housing at the awareness stage. Better communication channels that involve an introduction to how PV works, its benefits, and its short and long-term impacts could help to reduce uncertainty and would perhaps lead to more informal communication about the PV. An environmental show home may be a good place to hold consultation with potential PV tenants, although the case-study site is probably unusual in having such a show home nearby.

Although some tenants expressed concern about their bills increasing, it was striking that most study 1 participants apparently expected solar PV to save them money and seemed happy to switch to a quarterly bill and change supplier because of this.

Related to this issue is the fact that the panels were free of charge to tenants. It is feasible that this increases the degree of relative advantage for the tenant. Rogers (1971) discusses the use of incentives to encourage individuals to adopt a new technology. These may be cash payments or payments in kind to stimulate behaviour change. This is an important issue to consider in the present research. For example, the fact that the residents did not pay for the panels themselves may explain the apparent indifference towards the project that was reported in Chapter 8.

As well as expected financial benefit, positive attitudes towards PV panels and the project more generally were noted in terms of the appearance of panels and the benefit to the local environment (socially, in terms of the trust fund, and physically, in terms of regenerating the area). Benefits to the biophysical environment were also identified, but were mentioned less often. Residents said that they were very pleased with the change to the area and PV arguably made the area a more desirable place to live. Twigger-Ross and Uzzell (1996) found that regeneration of Surrey Docks helped residents achieve self-esteem and following this, this suggests that PV may have the potential to impact positively on self-esteem. Further research could explore whether enhanced self-esteem is a benefit of similar RET projects and what, if any, effects this has on place attachment.

Relative advantage in terms of status, prestige and uniqueness (expressed at both individual and collective level) were other reasons why tenants apparently held positive evaluations of the PV panels. This echoes the concept of distinctiveness, which is proposed as a contributor to self-esteem in Breakwell's (1986) identity process theory. Residents in this research remarked that having solar PV would make them different to other people. This suggests that examination of distinctiveness resulting from use of

renewable energy technologies, and possible effects on self-esteem, would be a useful avenue for future research.

Study 1 suggests that PV may increase place identification following Uzzell et al.'s (2002) theory of PRSI. In their paper, Uzzell et al. (Ibid.) suggest that distinctiveness is an element of place identification, as are beliefs about outsider perceptions and environmentally significant features of the area in which one lives. The data suggest that PV was seen as an environmentally distinctive feature of the Six Streets. Tenants talked about the 'observability' of PV, and reported discussions that they had with peers, relatives and passers-by from outside the community who stopped to ask questions about the PV. Observability of PV is also related to residents' aesthetic evaluation of PV, and suggestions that the PV project would improve the physical image of Braunstone, which has traditionally been perceived as one of Leicester's least desirable places to live. Again, further research could explore whether, if PV enhances place identification with what was formerly a derelict area, this leads to increased place attachment. Differences between PV and non PV tenants in this regard could also be explored.

Place identification, in Uzzell et al., (2002) theoretical framework is said to "make a significant contribution to identity" (Ibid. p49). Further research could examine whether PV has an impact on the relationship between place and identity.

There is some evidence from other studies that attachment affects identity when the strength of attachment has been increased by length of time in a residence (Knez, 2005), and so the longitudinal aspect of this study might illuminate this process. There was evidence that place attachment was high amongst PV tenants in the second study, but given that PV was evaluated negatively by the majority of tenants, there was no clear evidence that PV had any direct influence on attachment to Braunstone.

These findings suggest that as well as the six theorised attributes of innovations outlined above, image of PV was an additional attribute underlying respondents' evaluations of PV. Rogers' (2003) describes that this attribute has been noted in other diffusion studies

that expand on the six factors in the attribute-perception model. Also, Darley and Beniger (1981) and Guagnano et al., (1986) suggest that there are more attributes other than Rogers' theorised attributes and it seems reasonable to conclude that Rogers' list should not be considered definitive across all contexts.

Compared to the 1970s studies of consumer adoption of solar technology there were no clear differences in responses according to tenants' socio-demographic characteristics. There was some suggestion that age was related to the amount that was said about PV, with younger people talking less about the project and seeming more indifferent. This could have implications for ensuring that younger tenants, in particular, are engaged with in the consultation process for similar projects.

Study 1 found that perceptions of place affected perceptions of and attitudes towards PV, whereas evidence that PV affects relationships with place was not so clear. People talked about the area and how the PV would make it better, and also about how the trust fund would assist local regeneration. This seems likely to be pertinent because the project is taking place in a deprived area in which regeneration is in progress. Indeed, a striking finding was that people said that they thought that the motivation for the project was to improve the area. Once again, we might ask whether PV may increase self-esteem by helping people to feel positive about themselves because of improvements to their area.

The study shows that both positive and negative evaluations can be broken down into issues affecting the whole community (e.g. economic circumstances, trust fund, physical impact of PV) and issues affecting individuals (e.g. problems with PV installation, compatibility with household electricity systems, social risks). This illustrates that benefits and disadvantages of PV need to be understood at both individual and community levels.

Place-related identity theory provided a means of understanding some of the social impacts of the PV. Firstly, analysis suggested that attitudes and perceptions were often

formed by exchanges within heterophilious social networks. The most important influence on PV tenants' attitudes and awareness seemed to be communication with the change agent (local housing officer). This supports Rogers' (2003) suggestion that the change agent is an important source of information where an authority decision has been made.

Overall, there were positive perceptions of the housing officer, and it seems that the housing officer has the potential to be an effective change agent for a number of reasons. Arguably, the housing officer has a degree of similarity with the tenants, whilst at the same time being a professional with more knowledge of the PV process. In this instance the housing officer seemed to have a good understanding of local community culture, as well as being in a position to impart knowledge about the project. The use of Uzzell et al.'s (2002) theory also suggests a link between community life and DIT's emphasis on social networks. For example, tenants described their relationship with the housing officer across the interviews and she was well known to all of the PV tenants because of her presence in the community on a daily basis and the help she provided with housing issues. The housing officer was a 'social shared reference point' (Uzzell et al., 2002) and a heterophilious social actor and, as such, it is perhaps unsurprising that she was a conveyor of information regarding the PV.

Given that homophilious communication is proposed as the most common and effective method to stimulate the rate of adoption of an innovation (Rogers, 2003), it may be that the strong sense of social cohesion in Braunstone could be exploited to raise support for community RET projects in similar case-study sights.

Uzzell et al.'s (2002) theory also provides a basis for understanding other social aspects of the PV project. For example, perceived homogeneity was found to be an influence on positive attitudes towards PV and was also linked to financial relative advantage.

A place-related issue not considered in Uzzell et al.'s (2002) study, but relevant to this research, was envy (PV tenants saying that non PV tenants would be jealous of their

systems). This is an interesting aspect of what happens when technology meets society. PV was reported to have caused envy across the community, due to perceived economic relative advantage and wider issues relating to perception of recent social and political events such as place transformation and an influx of new tenants benefiting from the social and economic changes in the area. The conclusion from this finding is that the explanation of the beliefs about PV and the impacts of the project are explained by understanding the context in which the PV is happening and that concepts from PRSI theory aided this analysis. Furthermore, evidence of envy in the data was suggested to be underpinned by processes explained by theories of social comparison and social categorisation. Social categorisation theory was the basis for the development of social identity theory (Manstead et.al., 1996). The research reported in this thesis further strengthens the argument for Uzzell et al.'s (2002) assertion that identity is place related. It also suggests that social psychological theories of group behaviour, such as social identity theory, may be useful in future research.

Data on jealousy also raises the question of whether built form can affect social cohesion, and this may have policy implications for the fostering of social cohesion. As already explained, social cohesion, social categorisation and social comparison are concepts described within social identity theory (Uzzell et al., 2002). Social identity theory deals with differentiation between groups (the 'ingroup' and the 'outgroup'). In Braunstone, the solar panel project seemingly created jealousy across the community and a split between those without PV (outgroup) and those with PV (ingroup). The data describing the social dynamics of the area suggested that the regeneration in Braunstone created positive social change in the eyes of the participants (because some old, negatively perceived ties had been broken and there were improvements in social and physical terms), but that non PV tenants of the area may have viewed the regeneration negatively because of the perceived favouring of one small group. Avoiding such tensions would seem to be important in future projects of this type if community cohesion is to be safeguarded or enhanced.

This research suggests that distinctiveness and jealousy are also related to social cohesion within the neighbourhood. Distinctiveness has been found to be a component of place identity (Twigger-Ross and Uzzell, 1996; Uzzell et al., 2002). Therefore, PV may have the potential to play a part in place identity processes. It may enhance identity in relation to place at both the individual level (self-identity) and collective level (via place identification). Distinctiveness can be related to the status-conferring characteristic of PV, whereas jealousy can also be conceptualised as part of PV tenants' subjective experience of PV, but perhaps is best classified as an impact of PV rather than an attribute.

Moscovici's (2000) theory of social representations was invoked in interpretation of interview data because of its potential in aiding understanding of the references that five participants made to objects that are in some way both meaningful to the participant and related to solar PV. Social representations theory offers another framework for examining communication of a new idea or object not accounted for in PRSI or DIT. If considering existing beliefs about RETs and how these are formed, Moscovici's (2000) social representations theory may provide an explanation of how existing beliefs change in order for a new idea to be cognitively re represented by the individual.

Overall, these findings suggest links between social cohesion, the types of social networks described by Rogers' (2003), and the effectiveness of communication about the PV suggested in the data.

Other conceptual links between the two theories were made between place identification and observability, relative advantage and distinctiveness. These links arose from data suggesting that PV has status-conferring effects (distinctiveness) that may aid place identification, which is related to observability of the panels and this being seen as a positive aspect of PV. There seemed to be a conceptual link between distinctiveness and Rogers' (2003) concept of observability, in that the perceived status-giving aspect of the PV is related to how visible it is to other people who stop and ask questions. These conceptual links are further strengthened by the observation that the perceived attribute

of ‘observability’ was actually termed “communicability” by Rogers (1962) in his first edition of *Diffusion of Innovations*. This highlights the link between communication across interpersonal networks and the visibility of an innovation.

Visibility was closely linked with aesthetic evaluations. There is suggestion from the interview responses that PV changed the aesthetics of the neighbourhood in that a new visible technology was noticeable to PV tenants and non PV tenants. As such, PV was an environmentally significant feature of the neighbourhood which may enhance place identification (via perceived distinctiveness at the individual or collective level).

However, at the same time, responses suggest that the physical character of the area is not changed dramatically because PV is not deemed intrusive (i.e. it simply replaces existing roof slates, changing the colour of buildings’ roofs, but not the built form of the area, as might be the case with wind turbines, for example). The significance of this is that this case study provides evidence of the benefit of PV technology as a non-intrusive renewable energy technology. This may be a reason why there seemed to be indifference from some respondents to having PV installed on their homes.

10.3.1 Environmental concern

It is interesting that the present results echo Burningham and Thrush’s (2001) environmental concern findings. This provides some explanation for why the participants differ from those in 1970s studies in that the decision to adopt in those earlier cases was driven by environmental concern. Nonetheless, some interviewees in this research suggested that environmental concern does affect perceptions of and attitudes towards PV and some of the explanations for the positive perception of PV were quite detailed. Furthermore, study 2 suggested that many of the sample were interested in environmental issues. Hence, the extent to which environmental concern affects attitudes to RETs in low-income groups should be explored in further research.

Some interviewees in study 1 made a link between PV and the environment, and participants noted that they had seen advertisements and campaigns for energy efficiency on television. Given that climate change communication and media coverage

have increased dramatically since 2005, tenants may be much more aware of such issues now and it would be interesting to ask whether they made stronger links between PV and environmental issues now than when the interviews were carried out three years ago.

10.4 Towards a model of adoption of RETs in social housing

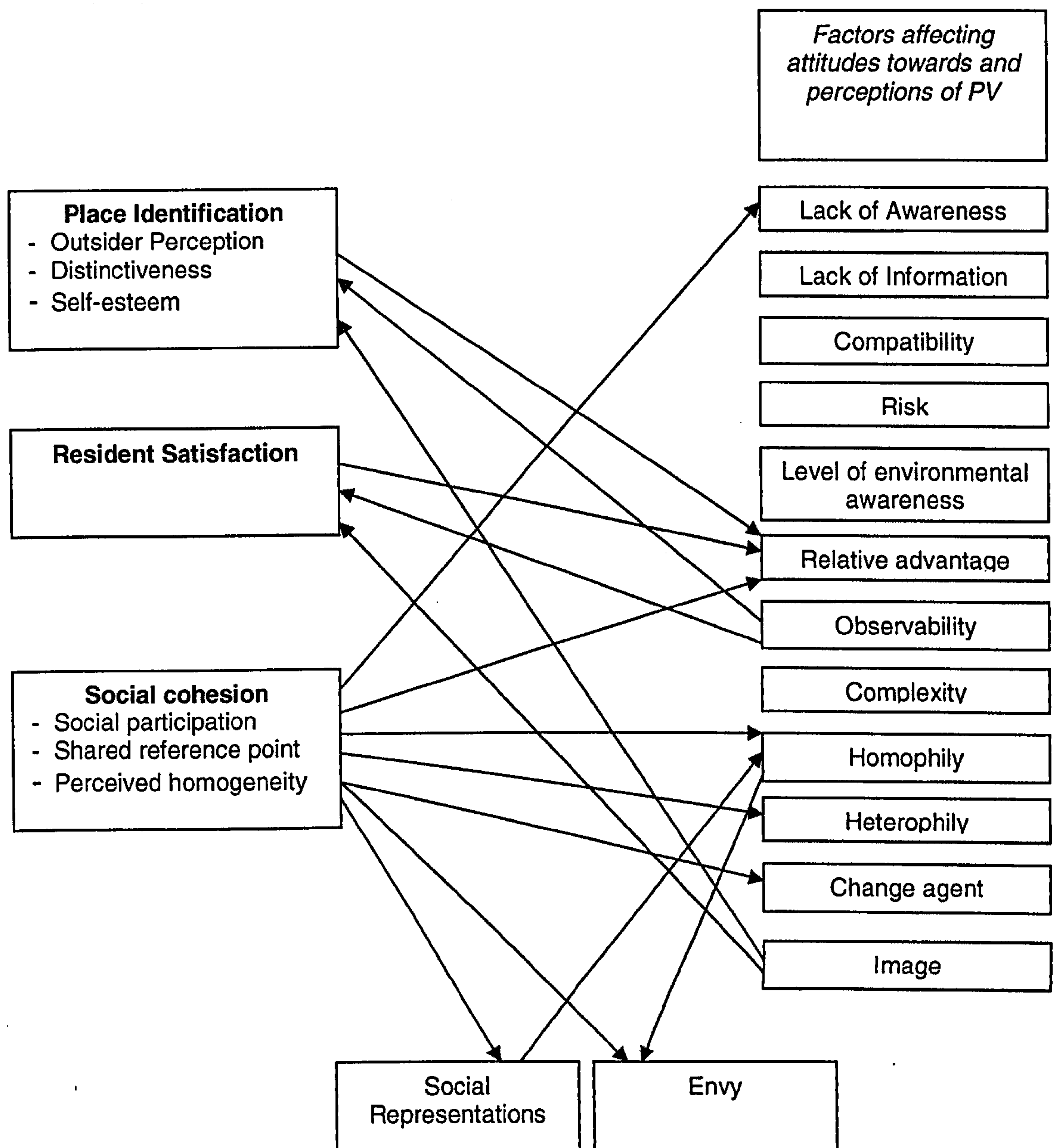


Figure 10.2 A model of an authoritative adoption of RETs in social housing

This model summarises assumes conceptual relationships between DIT and PRSI identified in exploration of factors affecting attitudes and perceptions of PV. These

factors may be important to social housing bodies. The model may not be generalisable outside of the case-study setting and does not account for every individual participants' attitudes toward or perception of PV. However, it is a model that attempts to capture all relevant themes found in the data. It is a speculative proposal that may act as a starting point for further research in this area'. Chapters 6-9 illustrated that many of the themes to emerge in the data were interrelated and this is shown in the model.

On the left hand side, are concepts that emerged from the data that are related to PRSI. On the right hand side are factors that affect attitudes to solar PV and this includes concepts from Rogers' six theorised attribute perceptions and concepts that relate to Rogers' descriptions of communication within a social system and 'awareness' which relates to the first stage of the innovation-decision process.

The arrows show conceptual links that were made during the data analysis. Broadly, it shows that Uzzell's conceptualisation of place identification links to positive attitudes towards PV because PV is seen as advantageous because 'people stop and ask questions', it may lead to distinctiveness and self esteem due to improvements in the area. All of these concepts are also linked to Rogers' concept of observability which is defined as how observable the results of an innovation are to the adopter and to others.

Perceived relative advantage of PV is linked to resident satisfaction because of the perceived social and financial benefits to the area expressed by PV tenants.

Observability and resident satisfaction are also linked because PV was deemed positive as it was seen as improving the physical environment.

Conceptual links are made between Rogers' (2003) flow of communication within a social system (homophily and heterophily) and Uzzell et al.'s (2002) constructs related to social cohesion. Within this, the concept of a shared social reference is linked to the change agent in this study.

The concepts of social representation and envy emerged in the transcripts but are not accounted for in Uzzell et al's (2002) framework of PRSI or DIT. However, social representation theory is concerned with shared communication in a social system and how this allows ideas and objects to become part of common sense understanding. The concept of envy is linked with social comparison and as such these two concepts are both related to social cohesion and flow of communication via social networks.

Links are also made between the theorised aspects of diffusion of an innovation and other factors that affected attitudes towards and perceptions of PV, that is, links between lack of awareness and lack of information with compatibility, complexity and risk. Observability is also related to image.

The change agent is linked to lack of awareness because the housing officer was responsible for imparting information.

10.5 Limitations of the research

Due to being a single-site case study, it is not possible to say how generalisable the findings are to other contexts. Further research concerning PV and other renewable energy technologies with low-income groups elsewhere is required. The present research does at least present a systematic study based on a clear theoretical framework which points to some interesting questions that could be used as a starting point for similar studies.

This study used social housing tenants and further studies could look at different socio economic groups and compare case study sites in order to see whether people have different attitudes towards and perceptions of PV in different contexts.

Due to time and resource constraints, the longitudinal aspect of this research used a questionnaire survey rather than repeat semi-structured interviews. Follow-up interviews may have provided a more in-depth picture of whether attitudes towards and perceptions

of PV had changed over time, and may also have provided a better comparison between individuals at the pre and post installation stages.

10.6 Future research

This chapter has discussed the findings and already made some suggestions for future work. This section provides a summary of suggestions made in the preceding pages.

Perceptions and attitudes towards PV panels amongst solar housing tenants in this case study were varied and complex across individuals. This suggests that perceptions and attitudes will vary according to the place and circumstances of the individual which corresponds to Uzzell et al.'s suggestion that each area will have its own pathway to sustainability. Given that issues unique to Braunstone were found to be related to PV, it could be that other neighbourhoods have different social-psychological factors affecting attitudes and perceptions of RET. Further studies could explore different geographical sites.

Conceptual links were made between DIT and PRSI theory and future research could use this framework as a basis to investigate attitudes towards and perceptions of other RET projects. Furthermore, social psychological theories of inter-group behaviour may be useful in exploring the phenomenon of envy.

Image was found to be a perceived attribute of PV in this study, but it may be that other perceived attributes would be revealed in different socio-demographic and geographical contexts. Future research could explore this further.

This study suggests that RETs will be evaluated favourably due to RETs potential to enhance self-esteem and distinctiveness. However, the study also found that risk, compatability and complexity affected PV tenants' attitudes. Further research could explore in particular whether self-esteem and distinctiveness lead to positive attitudes and whether risk, compatability and complexity are relevant to people's perceptions of

RET in other settings. If self-esteem and distinctiveness are found to lead to favourable attitudes towards RETs then the relationship between these variables and place attachment and place identity could be further explored. In particular it would be interesting to explore this in other social housing contexts due to the potential for increasing tenancy sustainment.

11 Conclusions

UK government is considering an ambitious CO₂ emissions reduction target (at least 60% by 2050) and many factors will determine whether this target is met. The present research suggests some conclusions and recommendations that may assist in increasing renewable electricity generating capacity in areas of social housing, which could help in the overall emissions reduction strategy. These are listed as ‘practical implications’ in the following paragraphs. ‘Theoretical implications’ which may guide future studies in this area are also listed. Conclusions and implications relating to each of the research questions set out in Chapter 5 are presented in turn.

Research question 1: Does interpersonal communication across social networks influence attitudes to PV? (DIT, Chapter 2)

Conclusion 1: Studies one and two showed that communication with the housing officer was critical in shaping people’s conceptualisations of PV. In some cases, this communication led to misconceptions about aspects of the PV project.

Practical implication 1: The change agent needs to be enthusiastic and knowledgeable and be able to relate to tenants. It is important to select the right change agent who has access to homophilious and heterophilious contacts within the social system.

Theoretical implication 1: Attitudes towards and perceptions of PV may be influenced by heterophilious social networks. In particular, a change agent may have a crucial influence. This supports the flow of communication through a social system as proposed in DIT (Rogers, 2003). Rogers’ notions of heterophily and homophily are useful in understanding the communication about the Solar Streets project and may also be useful concepts in future studies.

Conclusion 2: A finding of study 1 was that nearly all PV tenants reported that PV led to envy from peers across the neighbourhood. Both study 1 and 2 showed that this also was the case in other Leicester housing estates.

Practical implication 2a: Envy might imply a community relations issue which can further fragment communities rather than contributing to community cohesion (them and us). There is a need for institutions implementing similar projects to understand that the introduction of PV may become a point of contention and difference. This may be especially the case with a social system such that there is a tight knit community with little difference between households. Similar RET projects need to be tailored to prevent any disruption.

Practical implication 2b: Housing bodies need to consider implementation of projects across whole neighbourhoods, not just a sub set and have a way of proactively addressing such concerns.

Research question 2: Do tenants' perceptions of PV relate to the conceptualisation of perceived innovation attributes: relative advantage, complexity, compatibility, trialability, observability and risk? (DIT, Chapter 2)

2b) To what extent is relative advantage linked to the perceived financial benefit to the household of the PV panels (Chapter 2).

2c) To what extent do basic aspects of living with PV, such as changing from a card (pre-payment) meter to a credit meter and changing to a new electricity supplier, affect attitudes to PV? (DIT, relative advantage, compatibility and complexity, Chapter 2.)

Conclusion 1: Attitudes towards and perceptions of PV did seem to be influenced by the attributes that are assumed to affect rate of adoption as set out by Rogers (2003). In particular, study 1 showed that PV was rated favourably due to expected economic benefit (financial relative advantage). Social and physical benefits to the community were also spoken of. However, study 2 found that if tenants do not save money from PV then they will have a negative attitude towards it.

Practical implication 1: Potential financial savings on energy bills may be a useful lever for gaining acceptance of renewable energy technologies amongst low-income groups, but it is important that the savings are actually delivered if such claims are to remain credible. Nonetheless, if savings are made this may make changes such as a switch from pre-payment to credit metering more acceptable.

Theoretical implication 1: Rogers' (2003) attribute-perception model is useful in that relative advantage, risk, compatibility and trialability were helpful concepts in understanding tenants' accounts. However, for participants in this research, PV image also seemed to be important and this might usefully be included in further studies of a similar type.

Conclusion 2: PV tenants expressed different attitudes towards and perceptions of PV and there was diversity in the length at which participants discussed their perceptions and attitudes.

Ambivalence was a common response, reflecting a combination of:

- a) some perceived positive aspects of PV (e.g. financial, social and local and global environmental benefits).
- b) lack of awareness, understanding and uncertainty.

Practical implication 2: Awareness and education should be integrated into the initial stage of the project in order to reduce confusion about the installation and function of PV when there is a lack of information. This may be especially important when people are not active adopters (i.e. they are unmotivated at the initial stage). More consultation with individuals may help at the pre implementation (what Rogers 2003 would call the 'persuasion') stage. Tenants may benefit from being better informed of the impacts of PV and how the installation will affect individual households.

Theoretical implication 2: Rogers' (2003) innovation-decision model within the DIT framework is useful for understanding the stage at which PV tenants first became aware of the PV project. Rogers suggests that the persuasion stage of adoption is when perceptions and attitudes towards the innovation are formed.

Rogers' innovation-decision process may be useful in informing consideration of awareness and understanding and the consequences of a neighbourhood RET.

Research question 3a: To what extent are attitudes to PV influenced by perceptions of place? (Chapter 4)

Research question 3b: To what extent are attitudes to place influenced by PV? (Chapter 4)

Conclusion 1: Social and physical aspects of the local area apparently impacted on attitudes towards and perceptions of PV. PV was perceived positively because of perceived homogeneity, economic benefits to the community and regeneration in the area.

Conclusion 2: The PV and the trust fund impacted positively on perceptions of the local area (place), in terms of economic and social benefit.

Practical implication 1: Acceptance of PV among social housing tenants may be enhanced by stressing the benefits in terms of regenerating the area.

Theoretical implication: Uzzell et al.'s (2002) PRSI theory seems to be a useful framework, in addition to DIT, for studying how social and physical aspects of place affect attitudes towards and perceptions of RETs among social housing groups. This could be explored in further research.

Conclusion 3: Tenants' accounts suggested that the physical character of the area was not changed dramatically because PV is not deemed intrusive.

Practical implication 10: This study provides evidence of the benefit of PV technology as a non intrusive renewable energy technology.

Research question 4: Do issues of environmental concern relate to tenants beliefs about PV? (Chapter 4).

Conclusion 1: There was some evidence that concern for the environment had a positive impact on attitudes towards and perceptions of PV. Study 2 suggested that a high proportion of the sample were “very interested” in environmental issues, but was inconclusive as to whether this impacted on tenants’ attitudes towards PV. In the case-study site for the present research, saving money seemed more important to tenants than any environmental benefits. Tenants did not appear to be engaging in many energy-saving behaviours.

Practical implication 1: There seemed to be significant scope for behaviour changes to reduce energy consumption among research participants but encouraging such behaviour may rely more on stressing the financial benefits than benefits in terms of emissions reductions.

Theoretical implication 1: The extent to which environmental concern affects attitudes to RETs in low-income groups should be explored in further research.

Research question 5: Do PV tenants’ perceptions of and attitudes towards PV change over time, (from pre-installation phase to post-installation phase)?

Conclusion 1: Perceptions of perceived economic benefit of PV had apparently changed by the time of study 2. Several tenants expressed dissatisfaction that their bills had gone up (although it is important to note that dissatisfied tenants may have been more motivated to respond to the questionnaire than satisfied tenants and that the price of electricity increased considerably during the period over which the project took place).

Implication 1: The positive impacts of PV on distinctiveness and self-esteem may not be realised if the PV is seen in a negative light for financial reasons. This risk can be minimised through better education of the tenants on the function of the PV (i.e. its ability to provide electricity is not infinite) and energy awareness (e.g. tariff change).

Theoretical conclusion 1:

Concepts of risk and relative advantage of the PV system from the six theorised attribute perceptions may be especially useful in understanding attitudes towards and perceptions of PV amongst low-income tenants.

11.1 Recommendations

Following the conclusions and practical implications, this research makes the following recommendations for policy makers for improving on delivery of a neighbourhood renewable energy project.

Recommendation 1:

Ensure face to face education on an individual level tailored to the needs of the tenant. As far as possible this can be linked to wider schemes to reduce individual carbon dioxide emissions and communicate climate change in what might be considered 'difficult to engage communities'. Capacity needs to be increased if one housing officer (change agent) is not enough. Linked up working between installers, housing officers and residents should be the aim in order to provide the best advice and information to tenants.

Recommendation 2:

Financial savings need to be made more obvious if acceptance of renewable energy technologies among social housing tenants is to occur. Therefore, procedures need to be in place to make sure the RET programme is managed so that meter readings of overall

energy consumption and PV electricity output are taken which will help people understand why or why not they are saving/not saving money. Half-hourly metering could be installed and a detailed report should be sent to each RET tenant on how much electricity they consume, how much is exported and imported from the national grid and the subsequent carbon saving.

In addition, a central unit is needed on display in the house to tell tenants when they are using free electricity. This needs to be more engaging for the tenant than the import meter used in this study. Feedback could be given via TV, a website or a separate display.

Recommendation 3:

As mentioned in section 1.8 of this thesis, the researcher attended meetings and learnt that there were complications with installing the PV systems because it was difficult to get access to people's homes. This thesis therefore recommends that if in a situation where the houses are empty for refurbishment, then the PV systems and the meters should be installed before the housing association lets the property.

11.2 Further research

Further research recommendation 1:

Further research should be carried out to increase the scope of this project. There is a need for a mixed-method approach whereby data on the electricity generation of the PV systems is obtained and compared with data focusing on attitudes and perceptions of PV. This particular approach to research is espoused by Crosbie (2006) who suggests that "the monitoring of energy consumption is a necessity within household energy studies, as only this method avoids the issue of self-reported bias" (Crosbie, 2006, p748). For this research the use of half-hourly metering data, from each PV installation, would provide a more useful picture of the use of PV as a RET in an urban neighbourhood setting and whether such a project is financially worthwhile.

Furthermore the use of half hourly metering data could be collected to provide information on the electricity output from each PV unit to the tenants and the housing association, especially when it is considered that the cost of electricity monitoring equipment has fallen over the last five years since the PV project was implemented

Further research recommendation 2:

In conjunction with future research recommendation one, as well as measured data providing information on electricity consumption, tenants should be a) properly surveyed about their appliance use and interviewed again to see what their attitudes and perceptions of PV and their motivations and patterns are regarding appliance use. This data should be sought to see whether this corroborates with the recommended data monitoring. Rather than a survey as used in the second phase of this PhD research, attitudes towards and perceptions of PV would best be explored via interviews with tenants.

Further research recommendation 3:

Work should be carried out with the housing association to ascertain a) what happened to tenancy turnover rate over the years since project implementation and b) what lessons can be learnt for buildings regulation guidance in terms of energy efficiency in buildings from comparison between the new builds and the existing renovated stock.

Appendices

Appendix 1

Attitudes to Solar PV QUESTIONS

Thank you for agreeing to take part in this De Montfort University Study. The purpose of this research is to find out more about people's understanding of energy and it is linked with the Braunstone Solar Streets Project that is putting solar panels on your home.

I am hoping to conduct an interview over the next 45 minutes. Anything you say in this will be completely confidential and the interview will remain anonymous and will be used only for research purposes.

You are free to drop out of this study at anytime and if there are any questions that you don't want to answer then please say and we can skip on to the next question.

I am really interested in your opinions and anything you have to say so please feel free to tell me anything you like. There are no right or wrong answers to the following questions.

Do you mind if I record the discussion. Anything you say is important to the research and my writing skills aren't up to getting it all down on paper. Nothing you say will allow you to be identified.

SOCIODEMOGRAPHICS

What's it like living in Braunstone?

Do you think that it is a friendly place to live/have you got friends in the area?

Do you feel at home here?

How long have you lived in Braunstone?

How long have you lived in your house?

Were you born in Leicester?

HOUSEHOLD CHARACTERISTICS:

Marital Status:

Number of children:

Age of children:

How many people live in your house?

How many bedrooms in your house?

Do you own a car?

ENERGY CONSUMPTION

Is your cooker gas or electric?

Of the appliances that you have, which do you think uses the most electricity?

Are there appliances specifically that your children use?

Do you use portable electric heaters?

How important is energy efficiency in your house to you? PROMPT. Do you have any energy efficient appliances eg. Energy saving lightbulbs?

Have you seen or heard any campaigns about energy efficiency?

Do you know what the aims of these campaigns are/why these campaigns are happening?

Do you see energy efficiency impacting on environmental issues?

How much is your electricity bill usually?

Is it paid via card meter or quarterly/monthly bill?

(Now I'd like to talk to you about the payment of your bills...)

How easy or difficult have you found paying your bills in the past. Have you had any issues paying your heating bills? Gas OR electric.

Who tends to sort out paying your bills? You/partner?

Who is your electricity supplier/why?

Have you heard of an electricity supplier called ECOTRICITY?

Do you know what a 'green' electricity supplier is?

Do you know how much one unit of electricity is? How much do you think your supplier charges per unit of electricity?

How would you feel about changing from a card meter to a quarterly bill?

Multiple Sort Procedure for UNDERSTANDING of ENERGY

The next stage of the interview is a card sort. It is designed to see how people think about energy use. Please take your time and look at the cards and familiarise yourself with them. Any cards that you don't recognize, please tell me and I will tell you what they are.

Now I'd like you to sort these cards into groups. You can group them however you like and you can have however many cards you like in one group. All you need to remember is that all the cards you place in each pile have something in common.

Please remember that your answers are anonymous and that there are no right or wrong answers.

Example... blue sort pile...if I were to do this...

Also, feel free to talk out loud about what you're doing.

After Sorting

Why have you sorted the cards in this way?

What do the cards in each group have in common?

Do you think there is any other way that you could group the cards that is different to the way you've just done it – a second sort?

Structured Sort

Now I want to ask some specific questions.

From the cards

Please pick out different substances that you think electricity is made from.

Places/technologies/sources where electricity is generated/made/created.

Ways of transporting electricity

Ways of using or consuming electricity.

Impacts on the environment from using electricity.

Finally... sort the cards into piles with one pile of cards that you think are *dangerous*, one pile of cards that you think are **safe**, and cards that you don't think fit into either pile.

ENVIRONMENTAL BEHAVIOURS

How often do you do the following activities?

Never, a few times a month, a few times a week, daily

Recycle waste from home

Avoid buying things with too much packaging

Use drinking water sparingly

Avoid using the car for short journeys

Use low energy light bulbs at home

Support environmental Organisations

Talk about environmental issues with other people

Are you a member of an environmental organization?

ENVIRONMENTAL AWARENESS

What are your opinions on environmental issues?

Are there any issues that particularly concern you? Eg. Destruction of rain forests, the GM debate?

How concerned do you feel about global warming caused by greenhouse gas emissions?

EXISTING KNOWLEDGE OF PV

Finally I'd like to ask you some questions about the solar electric panels project.

What do you know about the about the Braunstone Solar Streets project?

How did you learn this information? Eg. Friends, newspapers

What do you think about it?/ Do you think it's a good thing?

What effects do you think it might have on people in Braunstone?

What organizations do you think are behind it?

What do you already know about solar panels?

Have you seen a solar panel before? PROMPT, books, newspapers etc.

If no, do you know what solar panels look like?

What do you think about the way they look?

Do you know anyone who has a solar panel?

Have you spoken to anyone other than the people/person you live with about the solar panels?

What do your friends think about you living in a home with solar panels on?

How do you think a solar electrical panel works?

How much do you think one costs?

How do you feel about having solar panels on your house?

What do you think it will be like?

PROMPT. Do you think it will be a good thing/are you looking forward to it?

How do you think having solar panels is going to affect your electricity bills?

PROMPT. How much do you think you will save?

How do you think the solar panels will affect how electricity works in your home?

Do you have any concerns about having solar panels on your house, do you foresee any risks? Health wise.

Do you associate solar panels with any type of person?

Have you heard about recent power cuts in the news, do you think that solar panels have any link to this?

Do you consider yourself someone who is comfortable using new technology?

Do you feel satisfied with your house as a home?

Are you happy with the service from your housing association?

Gender:

Age:

Ethnic Background:

Occupation:

Salary:

Are you receiving Benefits, if yes, which ones?

How old were you when you left school?:

Thank you very much for your time and effort. Can I finally ask if there are any other thoughts on solar panels that have not been covered in this interview?

This study will be ongoing over the next two to three years . I'll be doing a number of things in that time such as follow up interviews in about 12 months time. Are you happy for me to come back in the future to see how you're getting on with the panels.

Appendix 2



1



2



3



4



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10



11



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19



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Appendix 3

Attitudes to Solar PV QUESTIONS

Thank you for agreeing to take part in this De Montfort University Study. The purpose of this research is to find out more about people's understanding of energy and the Braunstone Solar Streets Project that is putting solar panels on your home.

I am hoping to conduct an interview over the next 45 mins. I'm going to ask you some questions about Braunstone and then move onto some questions about your house. After that I'd like to ask some questions about the solar panels and energy and then finally I ask you about your thoughts on the solar panel project. Anything you say in this will be completely confidential and the interview will remain anonymous and will be used only for research purposes.

You are free to drop out of this study at anytime and if there are any questions that you don't want to answer then please say and we can skip on to the next question.

I am really interested in your opinions and anything you have to say so please feel free to tell me anything you like. There are no right or wrong answers to the following questions.

Do you mind if I record the discussion. Anything you say is important to the research and my writing skills aren't up to getting it all down on paper. Nothing you say will allow you to be identified.

Interview is in 4 sections:

Themselves/ Braunstone/House

Understanding of solar panels/awareness of electricity supply/energy efficiency/electricity bills
Attitudes towards environmental problems
Awareness of project

OK, to start with, can you tell me...

1) What it's like to live in Braunstone?

PROMPTS:

Do you like it? If so, why?

Is it quiet/noisy?

How did you end up in Braunstone?

Would you say it feels like a community?

Do you feel at home in the community?

Are there events and activities going on in the community for you to participate in if you wish? Do you like this/dislike this?

What about your neighbours?

Who are your neighbours?

Do you get on with/trust your neighbours?

Now I'd like to ask you a bit about the 'Six Streets' and your house...

2) What is it like living in a new house on the 'Six Streets'?

PROMPT:

Do you like your house?

What do you like about it?

How long have you lived in it?

Do you think the 'Six Streets' feels a bit different to the rest of the place?

What do you think of as your neighbourhood?

Does the 'Six Streets' feel like your neighbourhood?

3) What do you think about having a solar panel on your house?

PROMPT:

What do you feel about it?

Do you think it will make a difference to you or to your house?

4) How do you think the panel will affect your electricity bills?

What about cheaper electricity bills?

How much do you spend on electricity usually?

Have you got a card meter?

Have you had any problems paying your bills in the past?

How much do you want to save?

How do you feel about changing to a new electricity supplier?

Have you any concerns?

Do you think it will enhance the look of your home?

Are you worried about vandalism?

Do you have many electrical appliances?

Do you own any energy saving appliances?

Do you think about saving energy?

What do your friends think about you having a solar panel on your house?

What do you think other people in Braunstone who live outside of the 'Six Streets' will think about you having panels?

Have you spoken to anyone about it.

Have you seen a solar panel before?

What do you know about solar panels?

A bit more about energy and environmental issues...

4) Where do you think electricity comes from?

IF THEY SAY I DON'T KNOW, PROMPT:

Is that because it's something that you don't usually think about?

If I say power stations or the grid, what does that make you think?

Do you think there will be any problems at night with your electricity when the suns' not out.

5) What are your opinions on environmental issues?

Does it bother you?

Now I'd like to ask you about the solar streets project...

6) What do you know about the solar panel project?

If they say "I don't know" then gently press, why don't you know?

What do you think about it?

7) Do you remember signing the agreement for the solar panels?

8) Did you receive any information about the project?

If so what did you receive?

9) Do you know who's behind it?

What do you think about them?

10) Have you talked to other people about the project? What do they think?

11) How do you think the wider community will be affected by the project?

My understanding is that a trust fund will be set up to help with heating people’s houses across Braunstone...

Did you know this?

What are your views on this?

Do you think this will be good for Braunstone?

SOCIODEMOGRAPHICS

Finally, please can you tell me your:

Gender

Age

Ethnic Background

Occupation

Salary/ Are you receiving benefits

What age did you leave school?

Marital Status

No. of children

Age of children

How many people live in house

How long have you lived in house

Do you have a car/allotment?

Are you a member of an environmental organization?

Appendix 4

A priori codes, following Miles and Huberman (1994) and King (1998). 15/06/05

SETTING	CODE	RES QUES
SET: HOME CHARACTERISTICS INSIDE/OUTSIDE	SET-HOM-CHAR-INS/OUT	3
SET: HOME ATTACHMENT	SET-HOM-ATT	3
SET: HOME ATTACHMENT/IPT	SET-HOM-ATT-IPT	3
SET: ATTITUDE TO HOME	SET-HOME-ATT	3
SET: BRAUNSTONE'S REPUTATION	SET-BRA-REP	
SET: 6 STREETS REPUTATION	SET-BRA-REP- 6 ST	
SET: BRAUNSTONE PLACE IDENTITY	SET: BRA-PL ID	3
SET: BRAUNSTONE SOCIAL IDENTITY	SET: BRA-SOC ID	3
SET: COMMUNITY	SET-COM	1
SET: SENSE OF COMMUNITY	SET-SENSE OF C	1
SET: SOCIAL NETWORKS OF FRIENDS	SET-COM-SOC NET/FRI	1
SET: FAMILY SOCIAL NETWORKS	SET-COM-SOC NET/FAM	1
SET: SOCIAL NETWORKS NEIGHBOURS	SET-COM-SOC NET/NEIG	1
SET: SECURITY VANDALISM	SET-COM-SEC-VAND	
SOCIAL CAPITAL		
SC: COMMUNITY ACTIVITIES	SC-COM-ACTIV	1
SC: COMMUNITY PARTICIPATION	SC-COM-ACTIV-PART	1
SC: TRUST IN NEIG	SC-TRUST-NEIG	1
SC: TRUST IN ORGANSIATIONS	SC-TRUST-ORG	1
ATTITUDE TOWARDS PV		
DIFFUSION THEORY REL ADVANTAGE	DIFF-REL ADV	2 2b
DIFFUSION THEORY BILLS	DIFF-REL ADV-BILLS	2b
DIFFFUSION FINANCIAL BENEFIT	DIFF-REL ADV-FIN BEN	2b
DIFFUSION COMPLEXITY	DIFF-COMP	2
DIFFUSION COMPATIBILITY	DIFF-COMPAT	2
DIFFUSION TRIALABILITY	DIFF-TRIAL	2
DIFFUSION OBSERVABILITY	DIFF-OBSERV	2
DIFFUSION RISK	DIFF-RISK	2
ATTITUDE TOWARDS PV INDIVIDUAL	ATT-PV-IND	5
ATTITUDE TOWARDS PV FAMILY	ATT-PV-FAM	5
ATTITUDE TOWARDS PV COMMUNITY	ATT-PV-COMM	5
PERCEPTION OF PV -IND/FAM/COMM	PER-PV-IND/FAM/COMM	5
BELEIFS PV -IND/FAM/COMM	BEL-PV-IND/FAM/COMM	3 and 5
PV KNOWLEDGE	PV-KNOW	3 and 5
PV STATUS/PRIDE	PV-STATUS	3 and 5
PV PROJECT		

ATTITUDE TOWARDS PROJECT/LEVEL	ATT-PVPROJ-IND/FAM/COM	5
PERCEPTION OF PROJ -IND/FAM/COMM	PERC-PROJ-IND/FAM/COM	5
ATTITUDE TO PROJECT INSTITUTIONS	ATT-PVPROJ-INST	5
ATTITUDE TO PROJ INSTIT NON PV	ATT-INST-NONPV	5
HOW SOCIAL NETWORKS AFFECT ATTITUDE	PROJ-SOC NETWORKS	5 and 1
ATTITUDE TOWARDS TRUST FUND	ATT-TRUFUN-GD/BAD	5
ENERGY		
ELECTRICITY CARD METER	ELEC-CARD MET	5b
ELECTRICITY CARD METER BILLS	ELEC-CARD MET-BILLS	5b
ELECTRICITY ECOTRICITY	ELEC-ECOTRIC	5b
ECOTRICITY QUARTERLY BILL	ELEC-ECOTRIC-QUARTBI	5b
ENERGY LITERACY		
ENERGY KNOWLEDGE A RATING APPLIANCES	ENG-KNOW-A RAT	
ENERGY KNOWLEDGE ENERGY EFFICIENCY	ENG-KNOW-ENG EFF	
ENERGY BEHAVIOUR APPLIANCES	ENG-BEH-APP	
ENERGY BEHAVIOUR ENERGY SAVING LIGHTBULBS	ENG-BEH-ENG SAV-BULB	
UNDERSTANDING OF TRANSMISSION	ENG-TRANSMISSION	
LINK WITH ENVIRONMENTAL CONCERN	ENG-LINK-ENV-CONC	4
ENVIRONMENTAL CONCERN		
ATTITUDE TO ENVONMENT	ENV-ATT-NO/YES	4
ENVIRONMENTAL CONCERN GLOBAL	ENV CONC-GLOBAL	4
ENVIRONMENTAL CONCERN LOCAL	ENV CONC-LOCAL	4
ENVIRONMENTAL ACTIVITIES	ENV-ACTIVITIES	4
PROJECT PARTNER CODES	IN ABOVE LIST Y/N	
TENANCY TURNOVER	NO	
MAINTENANCE CALL OUTS	NO	
UNDERSTANDING OF PV	YES	3 and 5
SWITCH TO CARD METER	YES	5b
VANDALISM TO PV	YES	5
JEALOUSY	NO	1
CONTACT WITH LHA	YES	5
CONTACT WITH ENVIRON	YES	5
INVOLVEMENT WITH RESIDENTS ASS	NO	5
DO PV RESIDENTS RECYCLE	YES	4
REL BET RENT ARREARS AND PV	YES	5b and 2b
ATT TO PV	YES	5
RESIDENT SATISFACTION	YES	5

Appendix 5

Contact Summary Form

Contact type: Interview

Today’s date: 14/05/05

Access: Friendly, easy

Contact Date:

1. What were the main issues or themes that struck me from the contact/transcript?

She has been living in house for one week and been in Braunstone for two weeks so hardly knows the area. Her first knowledge of the project was on meeting the researcher.

Seen solar PV on the ‘Six Streets’.

Has 2 energy saving light bulbs from a friend

Likes her house and garden

Is unsure about switch to card meter. “I’d need to find out more about it and decide then.”

Used to recycle (*Res Ques 5b*)

Father of one of the children in interview – household level not individual therefore. He spoke at the end and seemed concerned about the switch to a quarterly bill because he helps her pay some of her bills.

Misunderstood questions “what do you think of as your neighbourhood?”

And line 64. How do you think it will affect your current electricity system?

Both her and her partner ask me questions about the project at the end- RISK, COMPAT complexity. Partner talks about media representation of energy efficiency

2. How does the transcript relate to the conceptual framework and research questions. Which research questions were answered.

All of the research questions were covered as were all the concepts in the interview schedule. Ability to answer all of the questions was variable (sense of community questions) (social capital) due to length of time in the area.

Little knowledge of environmental issues and environmental concern is related to financial relative advantage. Attitudes to PV not affected by social networks

3. What information did I fail to get for my research questions? Any new speculations?

How attitudes change over time 5

4. What questions do I need to consider in the next contact?

Attention to switch to card meter/bills/financial relative adv.

Appendix 6

Residents' 'Solar Streets' Survey

Dear householder,

Your house is part of the Braunstone 'Solar Streets' project which has installed solar electric (photovoltaic or 'PV') panels on 50 homes. As this is one of the largest solar neighbourhood projects in the country, De Montfort university (DMU) and LHA are carrying out a study in order to assess the impact the project has had in Braunstone and to see what people living in solar PV homes think about PV and the project.

The purpose of this questionnaire is to investigate your views of the solar technology that is now installed on your house and your experiences of living with it. This is the second phase of a study assessing how perceptions of PV have changed since the panels were first installed.

There are no right or wrong answers and the questionnaire does not require that you give any detailed personal information. Any responses or information that you provide will be kept confidential and used solely for the purposes of the study. All questionnaires will remain anonymous.

The questionnaire will take fifteen minutes to complete. Please answer as many questions as possible, and answer as honestly as you can.

If you would like assistance in filling out this questionnaire, Kerry Kirwan from De Montfort University, will be available in Braunstone, from 1.30pm, on Tuesday 12th June and will be happy to visit your house.

Thank you for your time and co operation. Your views and experience are very important and greatly appreciated, as they will assist in improving future projects of this kind.

Once finished, please put the questionnaires in the pre paid envelope provided and post to LHA.

Many thanks,

Kerry Kirwan
Researcher, De Montfort University.

YOUR SOLAR ELECTRIC SYSTEM

1. When did you first learn that your house was to have a solar electric panel?

- ☐ Before it was installed
- ☐ After I moved into the house
- ☐ After it was installed
- ☐ Don't know

2. How did you first learn that you were having a solar electric system on your roof?

- ☐ Friend
- ☐ Neighbour
- ☐ Housing officer
- ☐ Other (*please specify*)

3. What information did you receive about the solar electric system? (*please specify*)

4. Were you satisfied with the type of information you received about having solar technology installed? Did you find out what you wanted to know?

- ☐ Yes, Very satisfied
- ☐ Satisfied
- ☐ No, not satisfied
- ☐ Don't know

5. How much do you feel you know about your solar electric system?

- ☐ A lot
- ☐ Enough
- ☐ A little
- ☐ Nothing

(Feel free to write down what you know:)

6. Who explained the system to you?

- ☐ Housing Association
- ☐ Friend
- ☐ Previous tenant
- ☐ Family
- ☐ Installer
- ☐ Other (please specify:)

7. Overall, how satisfied are you with your solar electric system?

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Quite satisfied
- ☐ Not satisfied
- ☐ Don't know

Is there anything about having a solar electric system that you would have improved? *(please specify)*

8. What aspects do you like about it?

- ☐ Saves me money
- ☐ It's good for the environment
- ☐ The look of the panels
- ☐ Other

(please comment on what you like about the PV:)

9. Are there any aspects that you dislike? *(please comment)*

10. Are there any aspects of the solar electric system that concern you?

- ☐ Maintenance
- ☐ Cost
- ☐ Safety
- ☐ Concerns about how much sun we get in the UK

11. Is your solar electric system easy to use?

- ☐ Yes
- ☐ No
- ☐ Don't know

12. Is there a meter showing you how much your electricity system is producing?

- ☐ Yes
- ☐ No
- ☐ Don't know

13. Do you ever look at the display to see how much the solar electric system is producing?

- ☐ Once a day
- ☐ Once a month
- ☐ Once a week
- ☐ Never

14. Were you satisfied with the installation of the solar electric system on your roof?

- ☐ Yes
- ☐ No
- ☐ Don't know

(If no, then why not?)

ELECTRICITY BILLS

15. Who is your electricity supplier?

16. Have you had any problems with your electricity supplier?

- ☐ Yes
- ☐ No

(If yes, please say what problems you have had)

17. How often do you pay your electricity bill

- ☐ By weekly account
- ☐ Monthly direct debit
- ☐ Quarterly bill
- ☐ Other *(please specify)*

18. Did you expect your bills to up or down once the panels started working?

- ☐ Up
- ☐ Down
- ☐ Wasn't sure

19. Have your bills gone down since your solar electric system has been working?

- ☐ Yes
- ☐ No
- ☐ Don't know

20. Do you know how much the solar electricity system has saved you?

- ☐ Yes
- ☐ No
- ☐ Don't know

(Please estimate)

21. Is it important to you to know how much electricity is produced by the PV panel?

- ☐ Yes very important
- ☐ Important
- ☐ I'm not bothered

22. Do you have any idea of the amount of energy being generated by the PV system?

- ☐ Yes
- ☐ No
- ☐ If yes, how much

BEHAVIOUR

23. Do you have any energy efficient lightbulbs in any of the rooms in your house?

☐ Yes

☐ No

(If yes how many?)

24. Since you have had your solar electricity system installed have you taken any steps to change the way that you use electricity in your home?

☐ I always switch off appliances when they are not in use

☐ I buy energy saving appliances

☐ Other (please specify:)

25. Have you changed electricity supplier since you had the solar electric system installed on your roof?

☐ Yes

☐ No

☐ Don't know

(Please specify)

26. Have you changed electricity supplier more than once since having your solar electric system installed

☐ Yes

☐ No

☐ Don't know

(Please estimate)

27. Has PV changed the way that your household uses energy?

- ☐ Yes
- ☐ No
- ☐ Don't know

28. Do you recycle?

- ☐ Yes
- ☐ No
- ☐ Don't know

IMAGE OF SOLAR ELECTRIC PANELS

29. Do you think the solar electric system has enhanced the appearance of your house or made it worse?

- ☐ Enhanced it
- ☐ Made it worse
- ☐ Made no difference

IMPACT ON THE COMMUNITY

30. Do you think that the solar PV project has enhanced the appearance of Braunstone?

- ☐ Enhanced it
- ☐ Made no difference
- ☐ Made it worse

31. What do you think other people think about the solar electric project ?

32. Do people stop and ask questions or comment on the solar electric panel project?

☐ Yes

☐ No

☐ Don't know

(Please specify)

33. If you have talked to other people are they people do they live

☐ In the 'Six Streets'

☐ The rest of Braunstone

☐ Outside of Braunstone

☐ Other (please specify:)

34. Where have you talked to these people?

☐ At home

☐ At work

☐ On the street

☐ In the pub

35. If other people have talked about the panels, have their comments been

☐ Negative

☐ Positive

☐ Don't talk about it

(Feel free to comment:)

36. How do you feel that your friends / family / others in Braunstone have not got a solar panel?

- ☐ I think more people should have solar electric systems installed on their homes
- ☐ I'm not bothered whether other people have it or not
- ☐ Don't know

37. Have you heard any complaints from other people?

- ☐ Yes
- ☐ No
- ☐ Don't know?

(If yes, what have they said?)

38. Would you recommend a solar electric system to a friend or relative?

- ☐ Yes
- ☐ No
- ☐ Why/why not?

39. Where do you think that the electricity that you use in your house comes from?

40. How has the PV project impacted on the community?

41. How important are green/sustainability issues to you?

- ☐ Very important
- ☐ Quite important
- ☐ Not important
- ☐ No opinion

42. How important is global warming to you?

- ☐ Very important
- ☐ Quite important
- ☐ Not important
- ☐ No opinion

43. Has your experience of having solar electric panels changed your feelings about 'green' issues?

- ☐ Yes
- ☐ No
- ☐ Don't know?

A BIT ABOUT YOU

44. Do you intend to stay living in your house?

- ☐ Yes
- ☐ No
- ☐ Don't know

(Why, why not?)

45. Address:

46. Which of these are you?

- ☐ Are you the tenant?
- ☐ Are you a friend or relative of the tenant?
- ☐ Do you live in the home permanently?
- ☐ How long have you lived in your house?

47. Did you live in Braunstone before living in your current house?

- ☐ Yes
- ☐ No

48. Age

- ☐ Under 18
- ☐ 18-24
- ☐ 25-30
- ☐ 30-35
- ☐ 35-45
- ☐ 45-60
- ☐ Over 60
- ☐ Over 80

49. ☐ Male ☐ Female

50. Ethnic origin.....

51. Did you take part in an interview as part of the De Montfort study?

- ☐ Yes
- ☐ No
- ☐ Don't know

52. Did the Green Doctor visit your house?

- ☐ Yes
- ☐ No
- ☐ Don't know

AND FINALLY...

53. How satisfied are you living in Braunstone?

Very satisfied

Satisfied

Not satisfied

54. Would you leave the Braunstone area if you could?

- ☐ Yes
- ☐ No
- ☐ Don't know

55. Would you leave your house if you could?

- ☐ Yes
- ☐ No
- ☐ Don't know

56. Which of the following best describes Braunstone people

- ☐ Everyone keeps themselves to themselves
- ☐ Everybody knows each other
- ☐ It is difficult to get to know people
- ☐ It feels like a community
- ☐ Don't know

(Please comment:)

57. Any other comments

Appendix 7

PV leaflet given to PV tenants

Braunstone Solar Streets

Information for Residents



Background to the Project

The Braunstone Six Streets Project will re-furbish 227 homes in North Braunstone, Leicester, to improve housing conditions. As one of the improvements photo-voltaic panels will be installed in 50 of the homes to generate electricity from light. This part of the Six Streets Project will be managed by Environ, Leicester's environmental charity, on behalf of the Leicester Housing Association which is managing the whole project.

Residents of the area were asked at an early stage to give their views, and Newlife, the construction company which will re-furbish the properties, has also been consulted. De Montfort University will study the scheme to assess the benefits to the residents.

This government-funded initiative, the second largest in the country, will provide a number of benefits for the area.

The 50 houses which have selected for this part of the project are all south-facing, which will give the best possible exposure to the sun's rays.

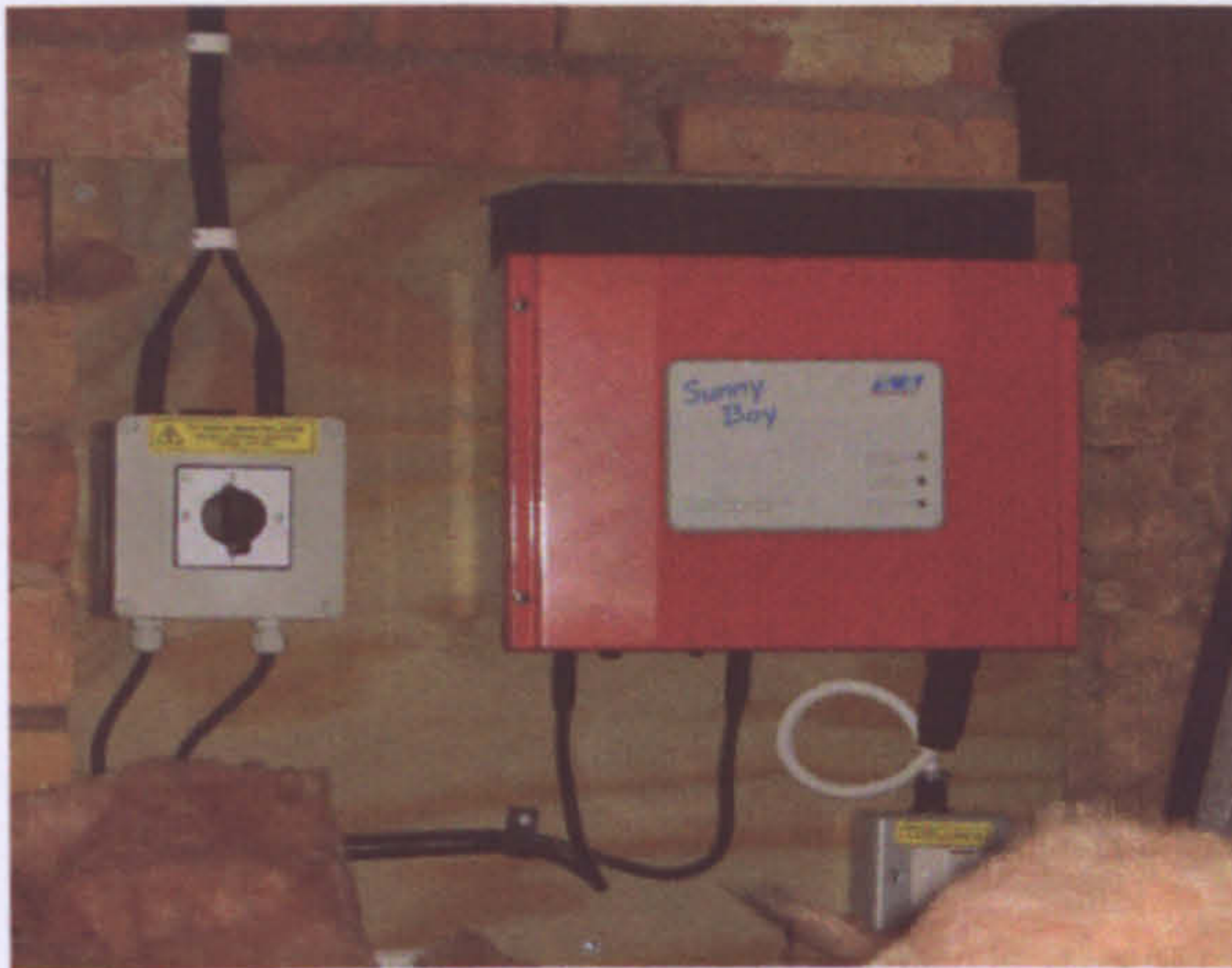
What is Photovoltaic?

Photovoltaic, or PV, means electricity from light. Photovoltaic systems use daylight to power ordinary electrical equipment such as household appliances, computers and lighting. The photovoltaic process converts free solar energy - the most abundant energy source on the planet - directly into electricity. This is different from the more familiar method of using the sun's rays to heat water for the home.

How does PV work?

A PV cell consists of two or more thin layers of semi-conducting material, most commonly silicon. When the silicon is exposed to light, electrical charges are generated and this can be conducted away by metal contacts as direct current (DC).

This DC current is converted to alternating current (AC) through an inverter (see picture below – the inverter has the words Sunny Boy printed on the front), which is smaller than a microwave oven and is located in the loft. This allows the electricity to be utilised in the home, for example for lighting and electrical appliances.



The electrical output from a single PV cell is small, so multiple cells are connected together and combined to form a module (sometimes referred to as a "panel"). The PV module is the principal building block of a PV system and any number of modules can be connected together to give the desired electrical output. PV equipment has no moving parts and as a result requires minimal maintenance. It generates electricity without producing emissions of greenhouse or any other gases, and its operation is virtually silent.

How do PV panels work on your house?

In a normal home electricity is purchased from a Utility Company and imported into the home. Electricity usage is measured by a meter and the resident pays the Utility Company for the amount of electricity used.

If you have PV panels on your roof which generate electricity, you can save on the electricity which you buy and also export any surplus. It's like having your own power station!

Your Utility Company and exported electricity

As this project is the first in the UK, an electricity supplier was approached to help develop the concept. Ecotricity were the only company that were willing to be involved and are providing a competitive electricity tariff. Ecotricity have also allowed Braunstone as a whole to benefit through the exported electricity.

The exported electricity is the electricity that is generated by the PV panels on the roof but is not used in the house. It is exported onto the National Grid.

The value of this electricity, from the 50 houses in Braunstone will be pooled by the Utility Company (Ecotricity) and given to the Braunstone Community Association (BCA). This funding which the PV has generated will be used by the BCA to install further energy efficiency measures across Braunstone. In this way the Braunstone Solar Streets Project will have benefits for the wider community, not just the residents of the 50 houses.

Therefore it is important that you stay with Ecotricity as your electricity supplier. However if you do want to change your electricity supplier you would be advised to speak to your Housing Officer, as it may mean that you will lose the benefits of free electricity.

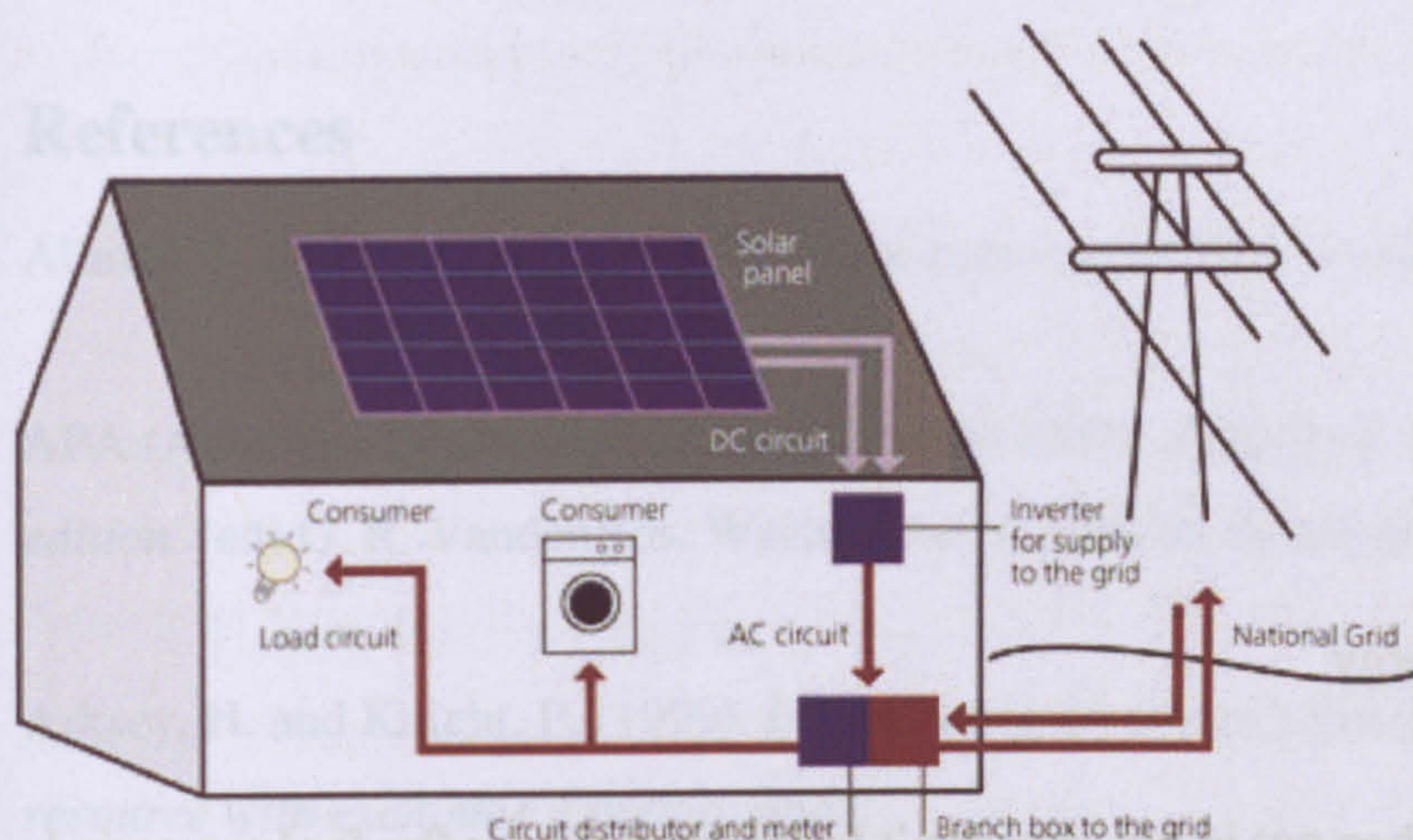
Why install photovoltaics?

Installing your own solar photovoltaic system means that you can generate your own electricity from the free and inexhaustible energy from the sun, hopefully reducing your electricity bills. A photovoltaic system never needs refuelling, emits no pollution, and can be expected to operate for over 30 years while requiring minimal maintenance.

Environmental Benefits

'With global climate change threatening all our futures, we need to switch to clean, renewable forms of energy and electricity production. Solar electric panels can generate

electricity that is free from pollution -a typical PV system on a house roof could prevent over 34 tonnes of greenhouse gas emissions during its lifetime.



Making the most of your PV panels

To make the most of the free energy generated by the PV panels you may want to use electrical appliances such as a washing machine when the sun is shining on the panels – generating electricity. You may also want to reduce your overall electricity bill even further by being more energy efficient.

How do I know the panels are generating electricity?

Generally speaking the panels on the roof should be generating electricity when the sun is shining. However the dial (see picture below, which is installed in every house) on the meter shows when you are generating electricity and how much. The electricity which your panels generate goes to your appliances first and then any surplus is exported – so the trick is to use the electricity you need when the panels are generating electricity, which will then cost you nothing.



Other Ways to Save Energy

- Switch off appliances when not in use, and don't leave them on standby for long periods.
- Turn down your heating thermostat – a 1° reduction could cut your heating bills by 5%
- Always use your washing machine for a full load
- Use low energy light bulbs where possible
- Don't heat your hot water too much -- 60° is fine for most houses

DeMontfort University Study

As mentioned at the beginning of this leaflet, DeMontfort University are studying the project over a three-year period. You may have already met or seen Kerry Kirwan, around Braunstone. Kerry is very approachable and any feedback you have on the project would be welcomed. Kerry is studying for a PhD and is specifically looking into the effects of the Braunstone Solar Streets Project.

environ



Neighbourhood
Renewal Unit

ec@tricity
renewable energy company

clearskies
RENEWABLE ENERGY GRANTS

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